November Steel Pushcars for Storming Trenches 15 Cents
PAGE 673

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641

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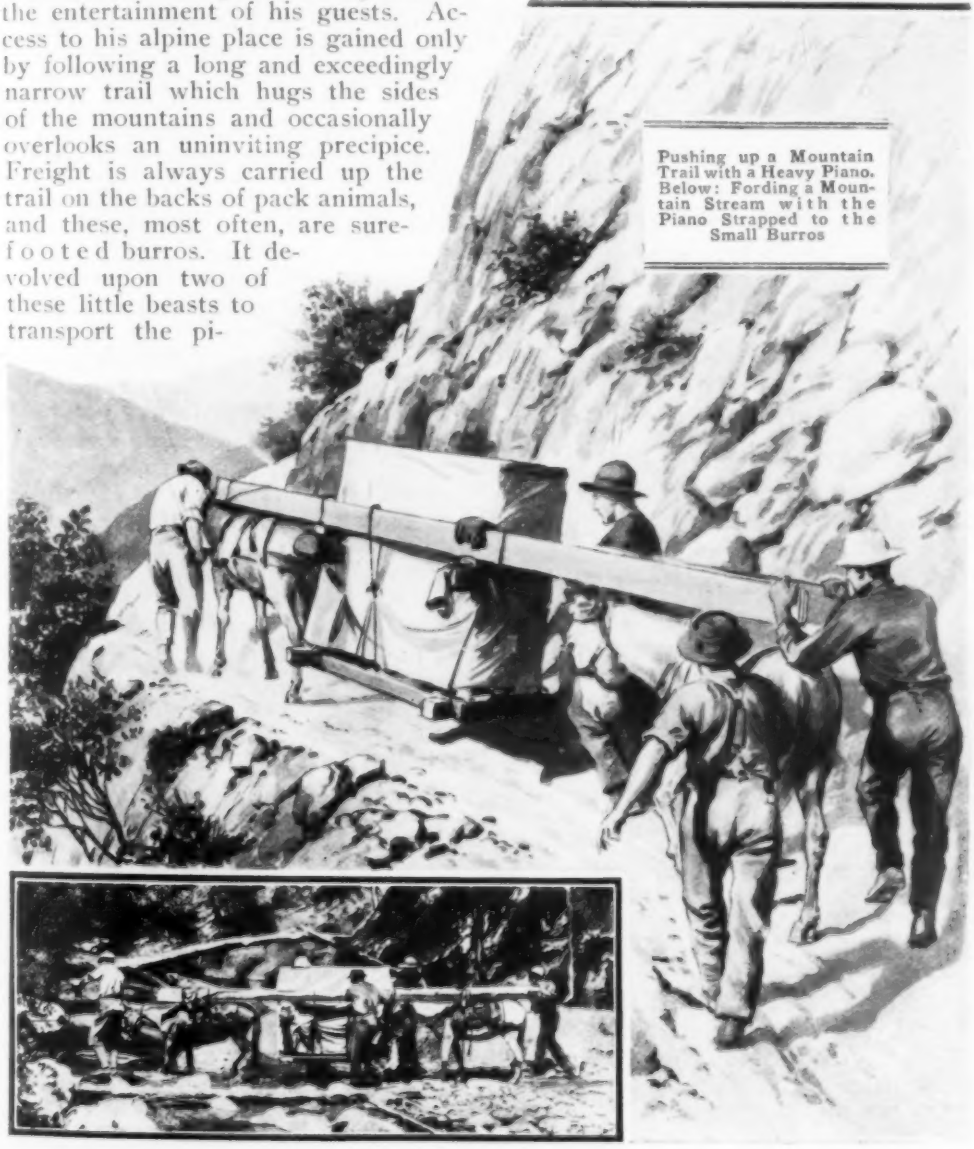
Vol. 24 NOVEMBER, 1915 No. 5

Piano Transported up Mountain by Burros

NOT long ago the proprietor of a mountain resort in southern California decided to purchase a piano for the entertainment of his guests. Access to his alpine place is gained only by following a long and exceedingly narrow trail which hugs the sides of the mountains and occasionally overlooks an uninviting precipice. Freight is always carried up the trail on the backs of pack animals, and these, most often, are sure-footed burros. It devolved upon two of these little beasts to transport the piano up the mountain, which they did with the assistance of several moun-

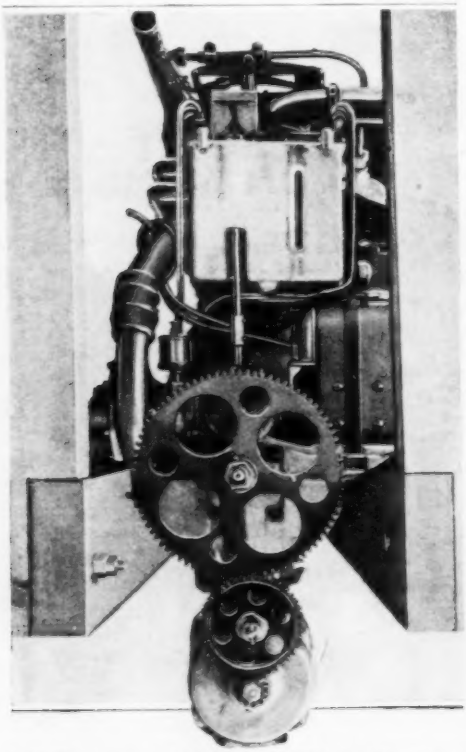


Pushing up a Mountain Trail with a Heavy Piano. Below: Fording a Mountain Stream with the Piano Strapped to the Small Burros

taineers. The heavy instrument was securely strapped to a pair of long timbers, the burros were placed at either end, and the planks lashed to the packsaddles. The men guided the animals and steadied the load. The burros negotiated the mountain safely and delivered the piano uninjured.

BRITISH PRODUCE STARTER FOR AERIAL MOTORS

One of the most interesting developments that has been made recently in improving aeroplane equipment has been announced in England, where an apparently practical self-starter for aerial motors has been constructed. The importance of this invention, especially from the standpoint of the military flier, is most obvious. The utter necessity for reasonable compactness and lightness in such mechanism has been the principal stumblingblock to be overcome in meeting aeronautical requirements. The device complete weighs only 84 lb. and is capable of turning over a 90-hp. motor continuously for two minutes at a speed of 50 revolutions a minute. The motor develops 1.4 hp. with 38 to 1 gearing and is provided with a 12-volt battery of 66 ampere-hour capacity. The apparatus is made as an integral part of the crank case.



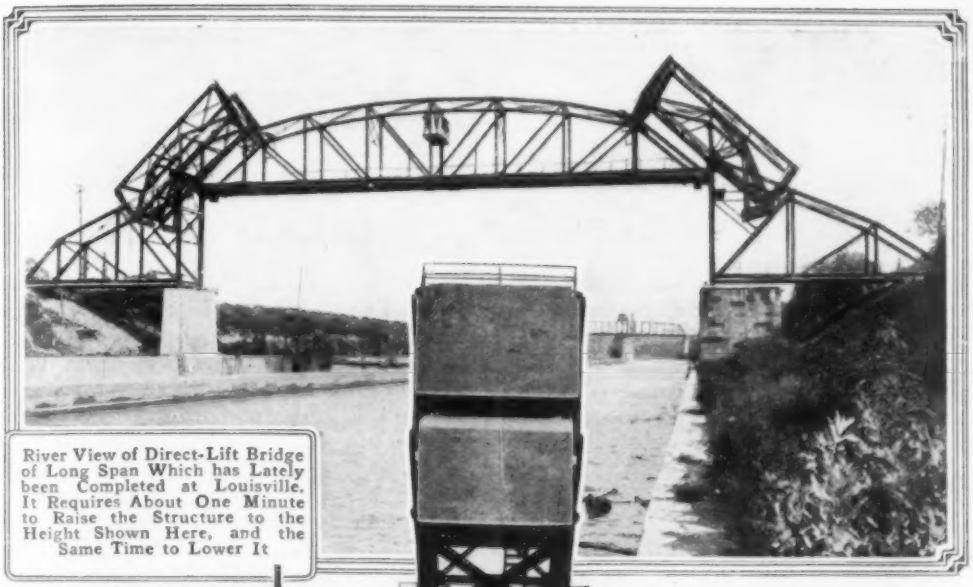
A 90-Horsepower Aerial Motor Fitted with One of the New Electric Starters, Which is Built as an Integral Part of the Crank Case

DIRECT-LIFT BRIDGE BUILT OVER LOUISVILLE CANAL

Across the widened Louisville and Portland Canal at Louisville, Ky., an interesting type of vertical-lift bridge has recently been opened to traffic. This is at Eighteenth Street and replaces an old swing structure of much smaller proportions which was erected years ago over the then narrow channel.

The main span of the new direct-lift bridge is 210 ft. in length, while the approaches are 75 and 85 ft. in length. The boats navigating the river at this point require a vertical clearance of about 55 feet at high-water level. This, and the length of the span, were two of the determining factors leading to the adoption of the present type of structure, which has a 40-ft. lift. The bridge is meant for vehicle traffic and has a 16-ft. roadway capable of carrying a live load of 100 lb. to the square foot.

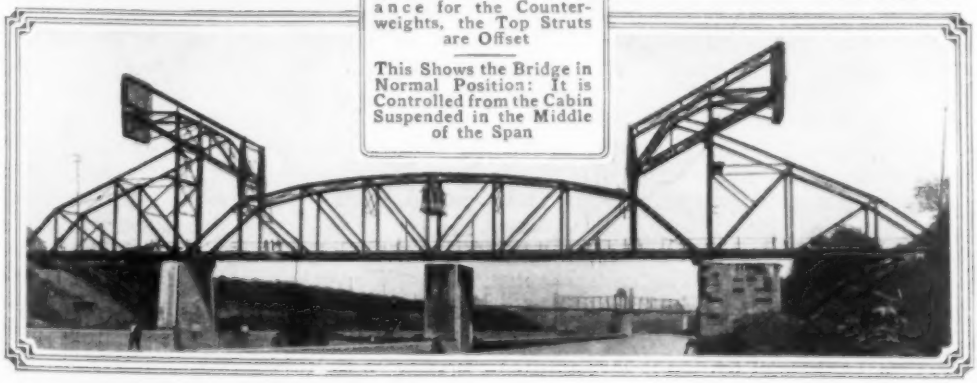
Weighted trusses pivoted to uprights fixed to the approach spans provide for the raising and lowering of the main span, which they counterbalance. The lower ends of the hangers are connected by pins to the ends of the lift span and the center points are pivoted to the vertical posts. The trusses are also connected at their outer extremities to the counterweight links, joining the weights. These latter members are connected to the trusses in such a way that the lift span and the centers



River View of Direct-Lift Bridge of Long Span Which has Lately been Completed at Louisville. It Requires About One Minute to Raise the Structure to the Height Shown Here, and the Same Time to Lower It

It will be Noticed That in Order to Provide Clearance for the Counterweights, the Top Struts are Offset

This Shows the Bridge in Normal Position: It is Controlled from the Cabin Suspended in the Middle of the Span



of gravity of its counterweights may be raised and lowered vertically.

The bridge is operated electrically and controlled from a small cabin situated in the middle of the bridge. There are four operating pinions fixed beneath the flooring, where they engage with racks attached to the inner side of the vertical posts at the four corners of the main span. One minute is required either to raise or lower the structure.

MACHINE ENABLES BLIND TO READ BY SOUND

BY the invention of an electrical "eye" through the medium of which sound waves may be developed from printed letters, a means has apparently been discovered for enabling the blind to read. A professor at the University of Iowa has built an apparatus which literally reads print. It is called a phonopticon, and in the course of experiments has shown itself capable of pronouncing various letters of the alphabet, as well as figures and other characters, by sounding different combinations of musical notes. By learning the particular sounds representative of each letter, a person unable to see is made able to read. It is even considered likely that the apparatus may ultimately be developed so that an impression of a painting or photograph may be conveyed to those deprived of sight.

The "eye," when in use, is moved along a line of text to be read. It is by means of this that other mechanism, which develops and carries the sound waves to the ears of the user, is actuated. Crystalline selenium, a peculiar element that is sensitive to light and a conductor of electricity, is the all-important part of the artificial optic. It is the effect which light has upon this substance that renders it valuable for this purpose. The conductivity of the crystal varies according to the intensity of its illumination, since the resistance of the material is reduced by exposure to luminous rays.

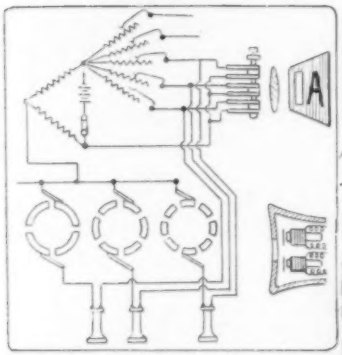
Three separated crystals are placed above an aperture in the reading device and so connected as to form arms of a Wheatstone bridge, which in brief is a device for measuring electrical resistance. When the "eye" is passed over blank paper the instrument is neutral. A bright band of light from an outside source moves with the "eye," illuminating each letter in turn. As the black outline of part of a character is reached its image is thrown through a lens upon one of the crystals. This shadow reduces the illuminated area of the crystal, increasing its resistance. In turn this unbalances the current and deflects a part of it into one of a series of three branch circuits. In each of these is an interrupter which produces a current of definite frequency. These impulses are converted into sound waves of a specific pitch by a resonator provided in each receiver.

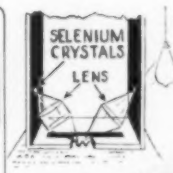
In this way, it may be seen, each part of a printed letter, as the upper, lower, and middle sections, acts upon a certain crystal and through it upon a separate interrupter and resonator. The frequency given the currents by the interrupters is governed by the number of segments of the latter and their respective speeds in revolving. The entrance of the successive parts of a letter into the illuminated area is instantly announced by a change in the pitch of the note.

In this particular instrument three telephone receivers are used. The number corresponds to the number of crystals employed, which it is possible to vary from one to four. In order to enable the use of more than two receivers, a pair is incorporated in one holder. These instruments replace the galvanometer of the Wheatstone bridge.

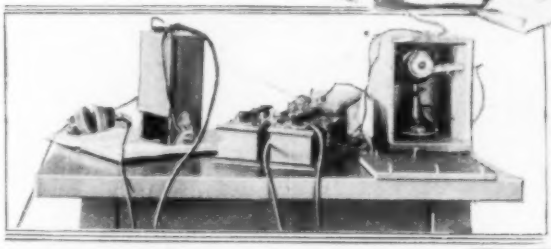
At its present state of development the apparatus weighs approximately 35 lb. and the electrical "eye" 2 lb. These weights are greater than will be required in a finished machine. The

This Illustrates the Combinations of Notes Rendered in Pronouncing the Word "With"





Cross Section of Instrument



Electric Eye being Passed over a Printed Page

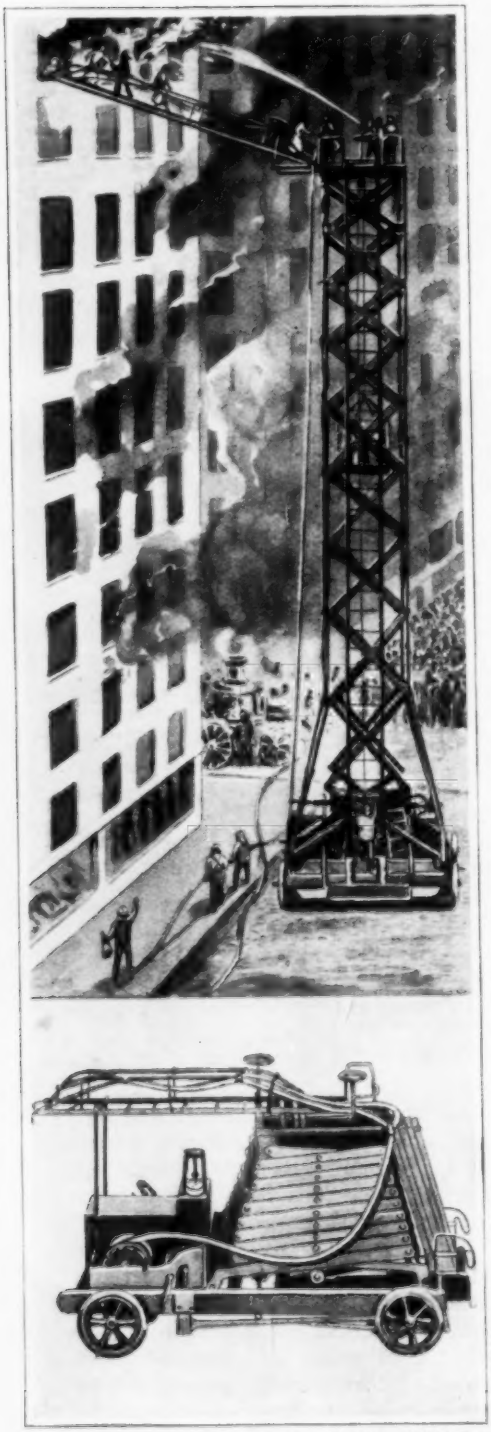
The Diagram Illustrates the Plan of the Phonopticon and the Relative Positions of Crystals, Lens, and Light Band as the Latter is Approaching "A." The Arrangement of Circuits is Also Shown. The Drawing at the Right Explains the Grouping of Receivers in Pairs. Photograph Exhibits Experimental Apparatus Which will Ultimately be Made Lighter and More Compact

Objections to the Present System of Touch Reading are Made Obvious by This Photograph, Which Shows Six Large Volumes of Raised-Letter Books, the Blind Man's Edition of David Copperfield

"eye" itself, which for convenience needs to be lightened considerably, can be made very compact and not more than a small fraction of a pound in weight.

The apparatus was recently tried out at a California institution for the blind and also at a convention of those engaged in promoting the welfare of blind persons. After a number of subjects had acquainted themselves with the different combinations of sounds peculiar to individual letters, they were able to distinguish letters and words more or less readily. Some of these tones are given in sequence, the letter "V," for instance, being rendered something like G, E, C, E, G, in the key of C major. The notes of characters having upright lines such as "L," "I," and "E," are rendered simultaneously, since the upper, middle, and lower portions act upon the selenium members at the same time.

It is the purpose of the inventor to perfect the machine so that it will be practical for use in any home where it may be needed. It is considered that it will be of value to persons with weak eyes whose businesses necessitate voluminous reading, and that it may also enable many blind persons to become self-supporting.



The Tower may be Elevated to a Height of 100 Feet in One Minute's Time. Its Appearance When Collapsed is Shown Below

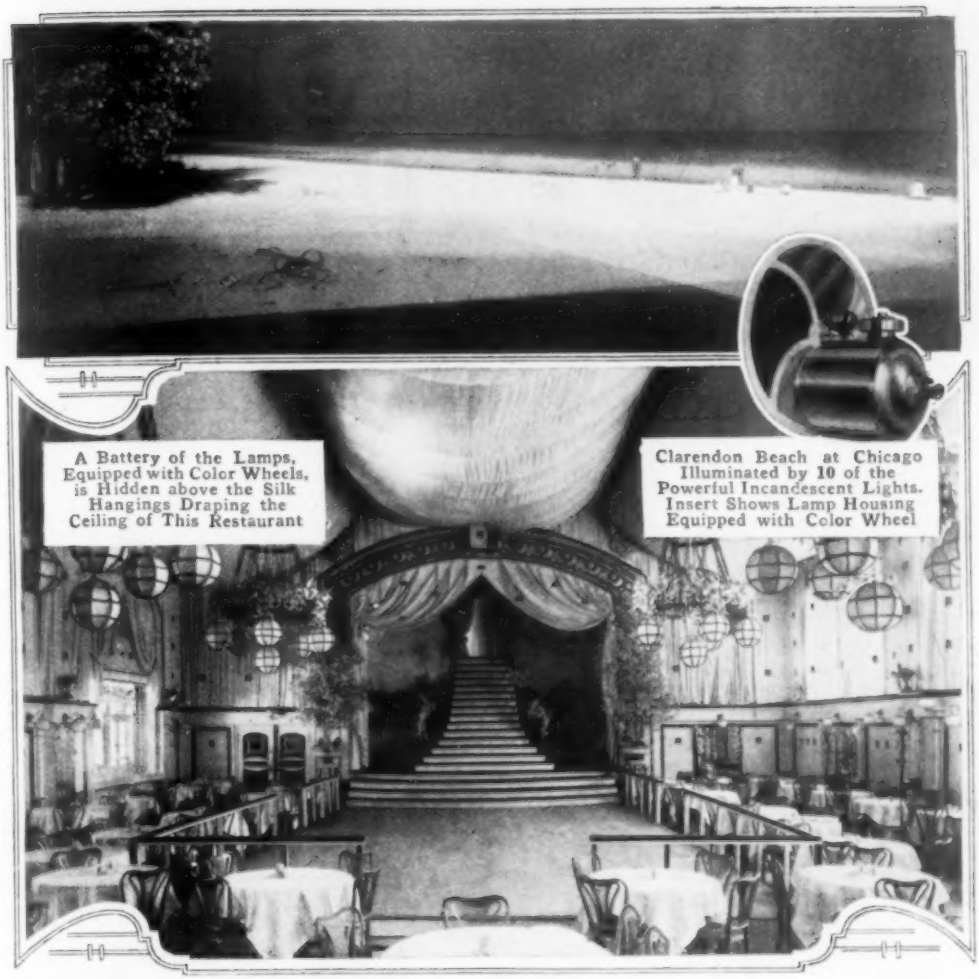
NOVEL COLLAPSIBLE TOWER FOR FIRE FIGHTERS

For life-saving and fire-fighting purposes, a Salem, Mass., inventor has designed a collapsible tower which may be extended to a height of 100 ft. in approximately one minute. Its plan of construction is not greatly unlike that of some of the folding observation structures employed in the field by European armies. At the top it supports a working platform for the fire fighters, on one end of which is fixed a short extension ladder which may be adjusted to various angles. In addition to this there is a jointed steel ladder reaching from the ground to the apex of the structure, which is raised into position with the rest of the apparatus. Fixed in the middle of the shaft is a basket elevator that is intended to be used for lowering persons rescued from burning buildings. Two leads of fire hose secured to the "fighting top" are carried up with the tower as it is raised. The device is intended to be mounted on a motor truck and operated by the machine's power plant. When collapsed it fills the space back of the driver's seat.

POWERFUL LIGHT PRODUCED WITH NITROGEN LAMP

Through the development of a specially designed reflector and projector-type housing for an incandescent lamp, a young western electrician has brought out a lantern which when fitted with a 1,000-watt nitrogen-filled globe produces a penetrating light rated at approximately 500,000 candlepower.

The lamp is suited for various indoor purposes and is also well adapted for brilliant exterior illumination. Simplicity, efficiency, and economy in operation make its use more convenient in many places than the more expensive and complex searchlight. It is because of these attributes that it is of especial value for night construction work in the open as well as for emergency and general purposes.



A Battery of the Lamps, Equipped with Color Wheels, is Hidden above the Silk Hangings Draping the Ceiling of This Restaurant

Clarendon Beach at Chicago Illuminated by 10 of the Powerful Incandescent Lights. Insert Shows Lamp Housing Equipped with Color Wheel

Batteries of these lights were used to assist the night rescue work at the time of the "Eastland" tragedy and proved very adequate. It was following this rather spectacular demonstration of their power that they were adopted for illuminating one of the municipal bathing beaches at Chicago where a number of accidents had occurred. It was desired to light the surf and shore both as a measure of safety and convenience to the bathers. Ten lights were used in this capacity with a result which may be partly appreciated by glancing at one of the accompanying illustrations. The several units, having an aggregate of about 5,000,000 cp., lighted the water for a considerable distance out into the lake.

A battery of four of the lamps equipped with motor-driven color wheels has been utilized in carrying out an interesting illuminating scheme at a Chicago restaurant. The ceiling has been draped with silk hangings, above which the lamps are installed. The color wheels are not operated in synchronism, so constantly changing and blending hues are cast upon the translucent silk and through it upon the diners.

A silverplated reflector is used with the lamp. At the back of it is a regulating device which enables it to be focused for use as a spot light, if desired.

DESTROYER SPREADING A SMOKE SCREEN

THE new 1,000-ton destroyers of the United States Navy, of which the "McDougal," shown above, is one, are equipped with oil burners for producing a heavy cloud of smoke that drifts on the surface and serves to conceal an attack on the enemy or to screen a battleship fleet from attack. In the recent naval maneuvers off Narragansett Bay the enemy submarines were easily rendered ineffective by these destroyers with their smoke screens.

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USING ANIMATED DRAWINGS TO ILLUSTRATE LECTURES

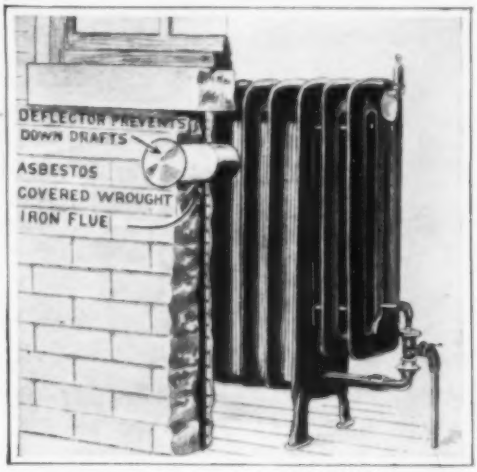
In illustrating a lecture in which armor plate and armor-piercing projectiles were discussed not long ago at the British Institution of Mechanical Engineers, an interesting employment was made of motion pictures. A number of drawings in which a shell was shown leaving a gun, hitting a plate of armor, the cap then breaking into pieces, the projectile passing through the metal protection and subsequently detonating, were filmed. The pictures when projected on a screen showed graphically what original photographs could not have portrayed. The drawings had been carefully executed and the resulting effect was good.

PORTABLE PLATFORMS USED BY SUFFRAGE SPEAKERS

When making open-air talks in various parts of the city, Philadelphia suffragists, who are carrying on a vigorous campaign for enfranchisement, employ portable speaking platforms which may be pushed from point to point. Fixed to the front legs of the wood framework is a pair of wheels. When a speaker finishes a talk she steps down from the elevation and tilts the stand so that the weight is carried on the wheels. Then, by using the platform railing as a handle, she pushes the contrivance along trucklike. Although somewhat cumbersome, it is not too heavy for a woman to handle. When erect, it forms a substantial platform.

STEAM RADIATOR HEATED BY GAS

One of the new features in heating equipment is a steam radiator in which the heat is supplied by means of gas,

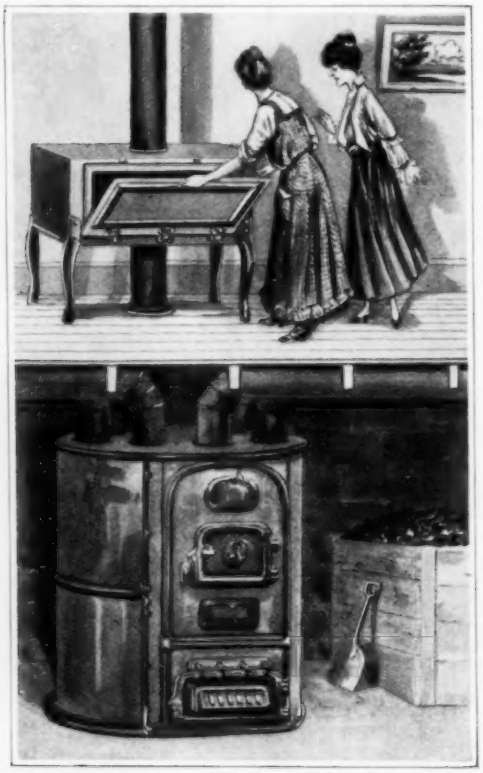


Steam Radiator in Which the Heat is Supplied by Gas: Each Radiator Forms a Unit and No Piping is Required

which may be either natural or artificial. Each radiator forms a unit, and no piping is required, as the water and steam simply circulate through the coils of the radiator. The gas burner is placed at the bottom under the center of the radiator. It is provided with a thermostat that controls the flow of the gas and keeps the steam at any required temperature. The products of the combustion of the gas pass through a pipe to the outside of the building so that the air in the room is not polluted. In operation, the water is heated and formed into steam at the bottom of the center coils and then passes upward and across the top to the overhanging coils at the ends. In these coils the steam is cooled and condensed, and the resulting water passes over the burner, where it is again formed into steam. In this way a constant circulation of water and steam is kept up. All that is necessary for placing the radiator in service is to pour about a gallon of water into the water-filling plug at the side and light the burner.

WASTE FURNACE HEAT USED BY CHIMNEY OVEN

To make it possible to utilize the waste heat of a furnace for cooking purposes, thus effecting a saving in gas



The Operation of the Chimney Oven Shown Above Costs Nothing, Since It Utilizes the Heat Given Off by the Smoke and Hot Gases Passing Up from the Furnace Beneath

consumption, an oven has been designed which bakes by means of the smoke and hot gases that ordinarily pass out of a chimney. It is intended to be installed either in a kitchen or basement adjacent to a flue. The outer jacket is made of range steel and the inner compartment of black iron. A pipe leading from the furnace is passed through the floor and connected with the bottom of this, while the outlet is fixed at the top and leads into a chimney. A hollow space between the walls of the oven provides for the free circulation of the smoke and gases, so that all sides are heated uniformly. This does not increase the fuel consumption of the furnace, so there is no cost whatever attending the use of the oven. It is especially economical in homes where much baking is done.

NOVEL STORE WITHIN WALLS OF STATE PENITENTIARY

Practically all of the provisions, personal articles, and permitted luxuries required by some 2,000 inmates of the Illinois penitentiary at Joliet are carried in stock at the prison store. To those who are unfamiliar with the ways of prison life, this supply house is probably a curious institution. Particularly is it interesting when one considers that it monopolizes the trade of a community which in the outside world would be supplied by a score of stores of various kinds.

Although it carries on a considerable volume of business, cash is not accepted as a medium of exchange at its counters. Money in hand will buy nothing at the store, where every purchase is charged to the account of the inmate buying it. If a prisoner wants a lead pencil and nothing else, a requisition is signed for the article, which is then charged against his balance in the penal bank, providing, of course, that he is fortunate enough to have a deposit there. Another particular in which this store differs greatly from the customary shop is that the goods are not displayed and no attempt is made to increase the business or show a profit at the end of the year.

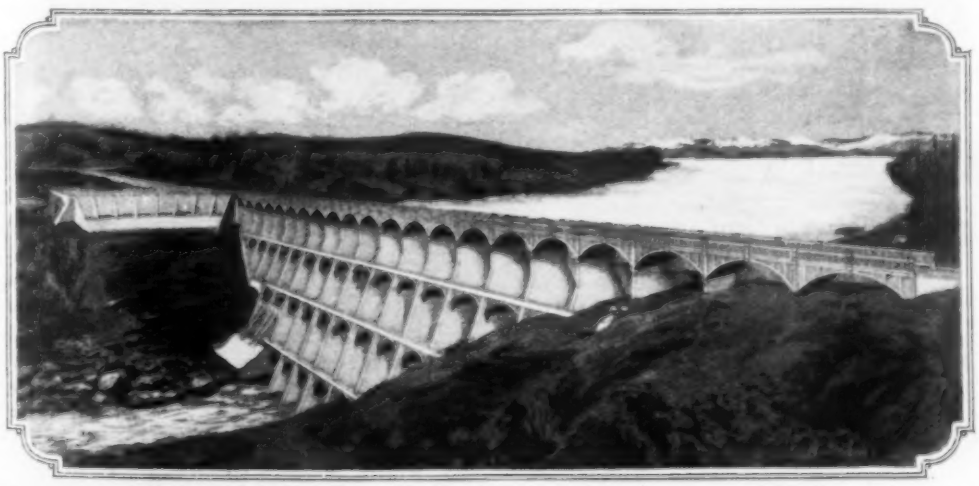
It is a practice to give each inmate in good standing his choice between a plug and a small package of smoking tobacco each week. Those who desire more tobacco than this, or who wish cigarettes, cigars, snuff, or other articles, such as playing cards, pencils, paper, underwear, handkerchiefs, and similar things, are permitted to order them. For this purpose four men make the rounds of the cells each week listing the individual wants of the inmates. These requisitions are subsequently filled and delivered the following week. Orders for candy and fruit are taken in the same manner monthly.

HYDROELECTRIC-POWER DEVELOPMENT ON THE PACIFIC COAST

How the Tremendous Water-Power Resources of the Sierras are Utilized for the Production of Electrical Energy

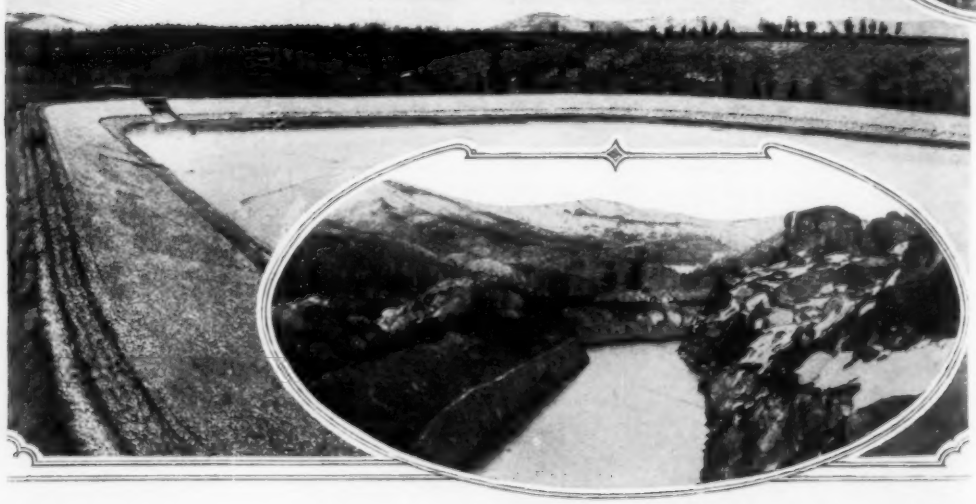
THE hydroelectric systems of the West, the greater part of which have been built in a period of about 12 years, constitute in the aggregate one of the biggest industrial developments this country has ever known. This development is due not only to the demands for power, but to the fact that because of its topography this section of the country is particularly favorable for the generation of electric current on an extensive scale by means of hydroelectric plants. It is estimated by government experts that out of a total of about 26,000,000 hp. which it is possible to develop in this way in the entire country, nearly 19,000,000 hp. lies west of the Rocky Mountains. Conditions for hydroelectric development are particularly favorable in the three states of the Pacific coast where the waters from the melting snows, discharged down the precipitous slopes of the high sierras, provide one of the greatest natural resources in the world for the production of electrical energy.

Electrically, the Pacific coast may be divided into distinct zones centering about the five principal cities. In the section about Spokane, Wash., power is chiefly supplied by one company, which has four water-power developments, all located on the Spokane River. The most important of these is the Long Lake development, the dam and power house for which are shown in one of the illustrations. The transmission system operated by this company consists of 600 miles of 60,000-volt lines. Power is supplied to a district within a radius of 100 miles of Spokane, the most important load center being in the Coeur d'Alene mining district in Idaho. In the Puget Sound country, Seattle is the electrical center. The needs of this section are also met for the most part by one company, which has approximately 75,000 hp. in hydroelectric developments and 35,000 hp. in steam stations. Farther south is a large electrical district having Portland, Ore., for its center. Here, out of a total of 85,000 hp. required for supplying the district, 54,000 hp. is produced by hydroelectric stations. San Francisco is the most important electrical center of the coast. Current for this and the adjacent cities is sup-



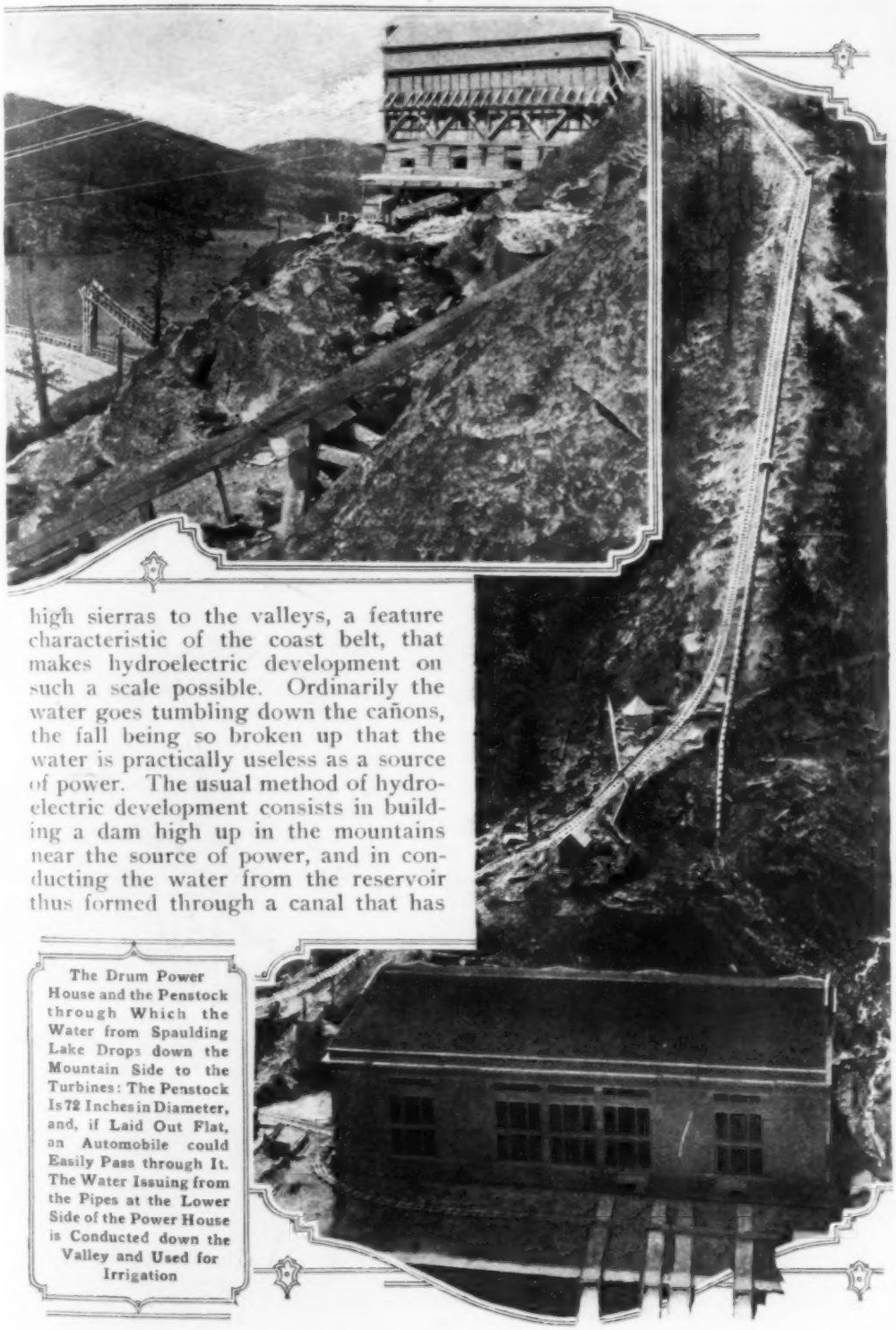
The Big Meadows Dam: When This Dam, 150 Feet in Height, is Completed, It will Store Up More Water than Any Other in the World with the Exception of the Assuan Dam in Egypt

The Picture at the Right Shows the Spaulding Dam Completed to a Height of 275 Feet, with the Stone-Crusher House, Aerial Cableways, and Other Construction Equipment Still in Place. Below Is a View of the Fore-Bay Reservoir and, within the Oval, a Typical Section of the "High-Line" Canal Which Conveys the Water from the Reservoir to the Penstocks



plied by three companies, each of which brings in hydroelectric power from long distances. In the district centering in Los Angeles there are a number of large hydroelectric stations, the most important, the Big Creek project, now being under construction. This project will ultimately be provided with four power houses through which the water will be used successively. The power will be carried 241 miles over three lines operating at a voltage of 150,000. With the completion of this system, the company operating in Los Angeles and vicinity will be able to supply 405,000 hp. In addition to these five electrical districts there are others of less importance. In California alone there are 110 reservoirs for hydroelectric purposes with a total storage capacity of 235,780,000,000 gallons.

It is the tremendous and precipitous fall of the water as it passes from the



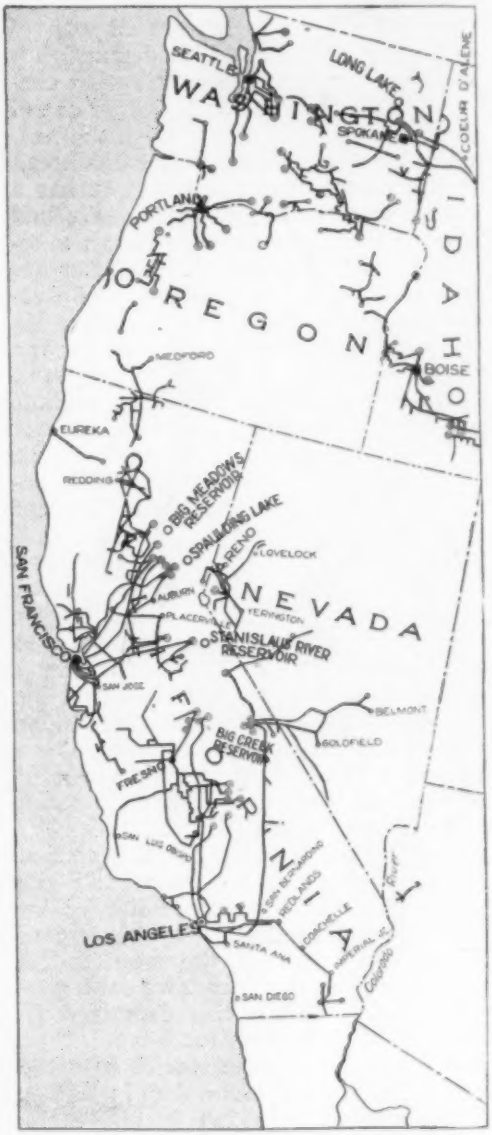
high sierras to the valleys, a feature characteristic of the coast belt, that makes hydroelectric development on such a scale possible. Ordinarily the water goes tumbling down the cañons, the fall being so broken up that the water is practically useless as a source of power. The usual method of hydroelectric development consists in building a dam high up in the mountains near the source of power, and in conducting the water from the reservoir thus formed through a canal that has

The Drum Power House and the Penstock through Which the Water from Spaulding Lake Drops down the Mountain Side to the Turbines: The Penstock Is 72 Inches in Diameter, and, if Laid Out Flat, an Automobile could Easily Pass through It. The Water Issuing from the Pipes at the Lower Side of the Power House is Conducted down the Valley and Used for Irrigation

The Long Lake Dam across the Spokane River, the Highest Spillway Dam Ever Built: The Fall from the Upper Ends of the Penstocks to the Turbines Is About 170 Feet, and in Time of Flood as Much as 19 Feet of Water Pours over the Crest

just enough fall to cause the requisite amount of flow, to a point where the entire fall can be concentrated in one tremendous drop. Such a canal must necessarily wind in and out for miles along the mountain sides, and its construction is usually a thing involving many difficult engineering problems. At the lower end of the canal are the penstocks through which the water drops down the mountain side through the turbines that drive the electric generators. Many of the plants operate on a vertical fall, or head, of a few hundred feet, while there are a number that operate on heads of from 1,000 to 2,000 ft. Under such heads as the latter the water strikes the turbines at an enormous velocity, the pressure being so great that no attempt is ever made to shut off the water at the lower end, owing to the danger that the entire plant would be wrecked by the resulting water hammer. With plants that operate under a head of 100 or 200 ft. the "high-line" canal is usually dispensed with, the penstocks taking the water direct from the reservoir and delivering it to the power house located below the dam. From the generators the current is sent to the distributing centers over transmission lines which carry voltages of from 60,000 to 150,000. One company supplying power to San Francisco operates more than 2,500 miles of high-voltage transmission lines. The electrical network of this company supplies current to more than 1,000,000 people, serving 30 of the 56 counties of California. This district comprises 32,431 square miles, an area one-half as great as that of all the New England states combined. Current for the Panama-Pacific Exposition is supplied by this company.

One of the best examples of hydroelectric development on a large scale is the Spaulding Lake system in California. Spaulding Lake is a reservoir located high in the mountains near Lake Tahoe and formed by one of the highest dams in the West. This dam is now 275 ft. high, and when fully completed is to be 350 ft. in height. The depth of water when the dam is built to the latter height will be such that if the Call Building in San Francisco



Map Showing Principal Transmission Lines and Hydroelectric Plants on the Pacific Coast

could be set just above the dam, it would lack 50 ft. of reaching to the surface. This dam serves the purpose of catching and storing the water that comes from the melting of the snow on the mountain peaks. The "high-

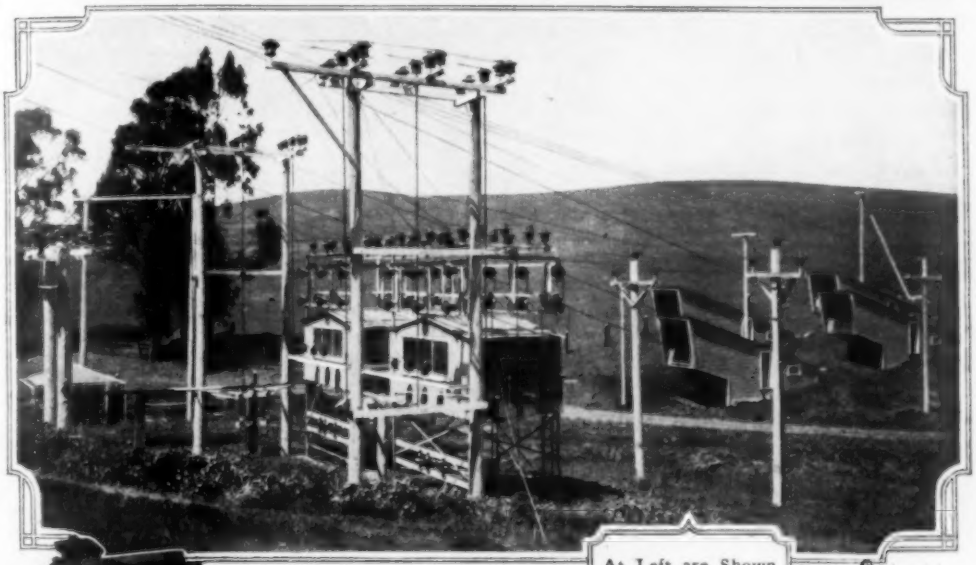
line" canal that transports the water from the reservoir to the power house is 16 miles long. At the lower end of this canal is the fore-bay reservoir, designed to hold a reserve supply of water for meeting sudden demands for extra power from the distributing centers. This reservoir is hollowed out of the top of the hill from which the penstock starts. Although it looks small in the illustration, the penstock has a diameter of 72 in., and if it were laid level it would be possible for an automobile to drive through it. After doing its work in the production of electrical energy the water issuing from the turbines is conducted down the valley and used for irrigation purposes.

One of the most remarkable dams yet built is the Long Lake dam across the Spokane River, 24 miles northwest of Spokane. This dam has the distinction of being the highest spillway dam ever erected. In time of flood it carries about 19 ft. of water over the crest. Here the power house is located directly below the dam, the fall from the upper ends of the penstocks to the turbines being about 170 ft. The power obtained in this way is sufficient for driving four 22,500-hp. turbines. Roller dams will eventually be mounted on the crest of the dam to keep the level of the lake the same during low and high water. It will not be necessary to employ the total head at this station for several years to come, and the roller dams will therefore not be installed until needed. The biggest of these reservoirs is the one to be formed by the Big Meadows dam, now under way. When this dam is completed it will store up more water than any other dam in the world, with the exception of the Assuan dam in Egypt. With a crest only 150 ft. above the bottom of the cañon, this dam will form an artificial lake having an area of 40 square miles and containing enough water to cover 1,325,000 acres of land to a depth of one foot.

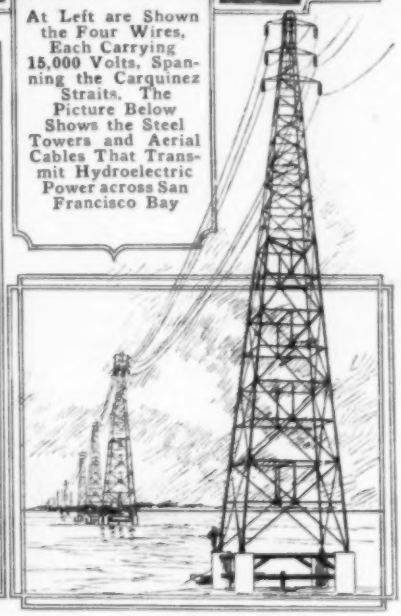
As interesting and as difficult in an engineering way as the construction of the hydroelectric stations is that of some of the high-voltage transmission lines. This is particularly the case with the lines centering in San Francisco, which is located at the northern end of a long, narrow peninsula. Power from Spaulding Lake is taken across the Carquinez Straits and around the southern end of San Francisco Bay. It is this line that supplies San Jose. The other two companies avoid this long and circuitous route by crossing the bay, one with a submarine cable and the other with aerial cables. The submarine cable crosses under the bay from Oakland. It is about three and one-half miles in length and carries a voltage of 12,000. This is said to be the longest submarine cable in the world transmitting current at as high a voltage as this. The aerial cables across the bay were installed by a company that supplies most of the current for the traction system of San Francisco. The hydroelectric plant of this company is located on the Stanislaus River about 125 miles from San Francisco, and the transmission line encounters the bay several miles south of Oakland. A narrowing of the bay known as Dunbarton Narrows was selected for the crossing. The transmission lines are carried across the bay on steel towers built high enough to provide ample clearance for the navigation using this part of the bay.

One of the most striking features in transmission-line construction is the crossing of the Carquinez Straits, where the longest wire spans in the world are in operation. The valleys of central California are drained by two rivers, the San Joaquin and the Sacramento. These two rivers come together to form San Pablo Bay, which in turn empties into San Francisco Bay. The problem of transmitting to San Francisco the power from Spaulding Lake was therefore a serious one, owing to the obstacle interposed by this body of water. About midway between the east and west ends of the bay the shores come comparatively close together and form the Carquinez Straits, and at this point the crossing was made. Owing to the depth of the water the placing of towers in the

The North End of the Carquinez Crossing, with the Leaning Tower at Left. At the Right in the Picture Below are Shown the Houses for the Anchorages That Take the Tension of the 4,420-Foot Wire Spans



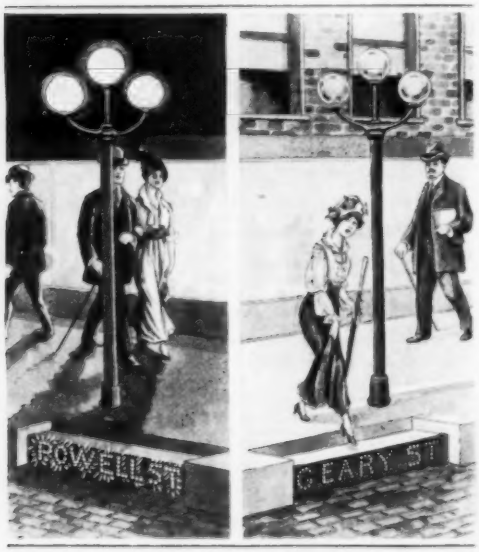
At Left are Shown the Four Wires, Each Carrying 15,000 Volts, Spanning the Carquinez Straits. The Picture Below Shows the Steel Towers and Aerial Cables That Transmit Hydroelectric Power across San Francisco Bay



straits was out of the question. At the same time it was necessary to keep overhead wires at such a height as to clear navigation. Between towers erected on the high land on each side of the straits near Benicia, four wires are stretched, so that at the lowest point they clear the water 206 ft. The distance between towers is 4,420 ft. With the tension resulting from such a span as this, some delicate and difficult problems in design were involved. Strong anchorages for the wires were required, and, since each wire carries 15,000 volts, careful work was necessary in designing and constructing these anchorages in such a way as to prevent danger of grounding. The anchorages are placed in specially designed houses. In addition to the anchorage on the north shore, it was found necessary to construct a leaning tower, which is shown in one of the illustrations. Some time after the wires were stretched it became necessary to paint them, and this work furnished a very good test of the strength of the installation. A trolley device was suspended from one of the wires, and on this an attendant worked his way across the straits, painting the wires as he went and completing the work without placing excessive strain on the wires or their anchorages.

STREET NAMES DISPLAYED BY CURBSTONE SIGNS

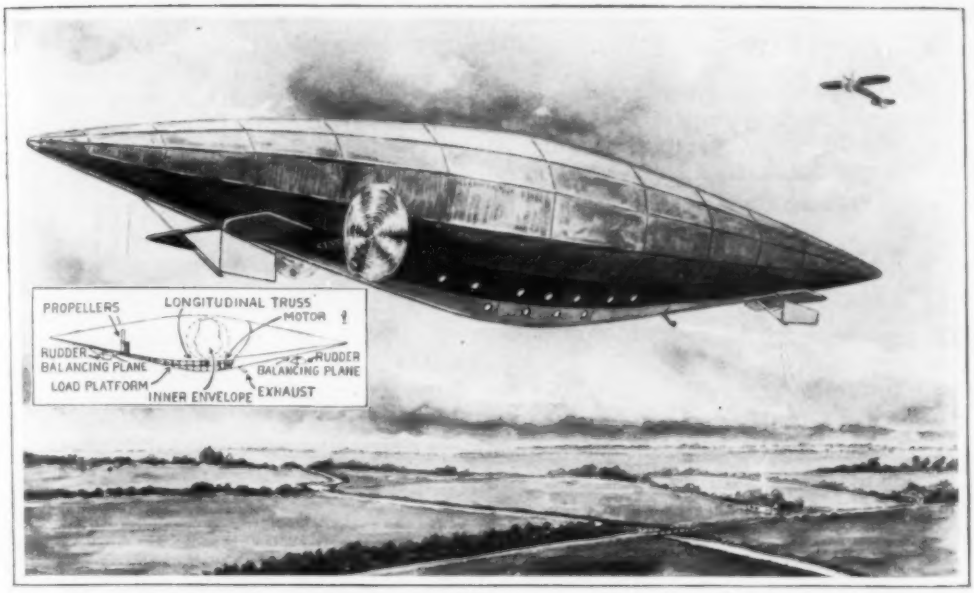
At an intersection of two thoroughfares in the business district of San Francisco an experiment is being made with a novel plan for displaying street names. Electrically illuminated signs bearing the street titles have been imbedded in the vertical sides of the curbs. These consist of waterproof cast-iron boxes, 40 in. long and 8 in. deep, perforated with the street names and illuminated by means of tubular electric lamps which are connected with the city lighting system. Two of these signs are installed at each of the four corners at the intersection.



Besides Showing the Street Name, the Sign Lights the Curbstone for Pedestrians

DIRIGIBLE BALLOON MADE RIGID BY GAS PRESSURE

What appears to be one of the most important inventions of recent years in the way of air craft is a dirigible balloon, recently patented by a prominent American scientist and inventor, in which no interior framing is used, the envelope being held to its proper shape by the pressure of the contained gas. This dirigible is designed to fly at speeds of 60 miles an hour or more without danger that the envelope will be deformed in the least by the pressure of the air. The secret of this accomplishment lies in the shape of the envelope and the maintenance of the right gas pressure. Instead of the rounded ends characteristic of Zeppelins and most other dirigibles, the envelope of this dirigible has the shape of two cones placed together base to base with the points projecting to the front and rear. With this shape the head pressure of the air is evenly distributed over the forward half of the envelope. The displaced air, instead of



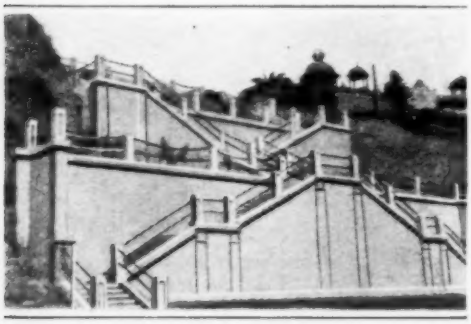
New Dirigible, Recently Invented, of the Type in Which Interior Framing is Replaced by the Pressure of the Gas Contained in the Envelope

eddying behind the envelope, presses in radially against the rear half of the envelope with a pressure about equal to the head pressure with friction not taken into account. In this way the gas is made to act practically as a compression member running longitudinally of the envelope. The maintenance of the proper gas pressure is a matter of vital importance. This is accomplished, and the inevitable leakage of gas is overcome, by means of a ballonet placed within the main envelope and designed to be expanded, as required, with compressed air, the air being pumped in through a valve that connects with a blower by means of a pipe passing through the bottom of the envelope. When the gas is at the required pressure this ballonet is empty and flat. As the pressure decreases air is pumped in and the expansion of the ballonet from this cause restores the pressure, this process being continued as often as may be necessary until the full capacity of the ballonet has been utilized.

While apparently this arrangement will enable the envelope to resist deformation from the pressure of the air, it is necessary to provide some rigid means of distributing the load carried to prevent the envelope from being drawn downward and out of shape at the points where the loads are attached. This is accomplished by means of a truss, curved to correspond to the underside of the envelope, and running from the nose to the stern. The truss is suspended from the sides of the envelope without the use of a net, and on it are carried the car, engine, propellers, and other accessories. Two propellers are used. These are located one on each side of the envelope about midway between the center of the craft and the nose. They are supported on the truss at such a height that their axles are about level with or a little below the longitudinal center line of the envelope. With this arrangement there is little of "bucking" at high speeds, and the craft is in effect drawn through the air instead of being driven through it. The propellers are connected by a differential gear, a feature designed to insure an equal pressure under varying air conditions. Ease of handling is provided for by equipping the dirigible both fore and aft with horizontal and vertical rudders.

STAIRS CONNECT STREETS ON DIFFERENT LEVELS

In some hilly cities it is not unusual for a more or less important street to end abruptly at the crest of a high



The Staircase Provides Communication between the Two Highways for Pedestrians

embankment or cliff, many feet above what would be an intersecting artery were the two built on the same level. This is the condition of a well-known street in Los Angeles. The annoyance of having it end some 50 ft. above Lake Shore Avenue, preventing communication between the two traffic lanes, has been partially overcome by the construction of a large reinforced-concrete stairway which provides access for pedestrians.

LOCOMOTIVES FOR SIBERIA RAILWAY BUILT HERE

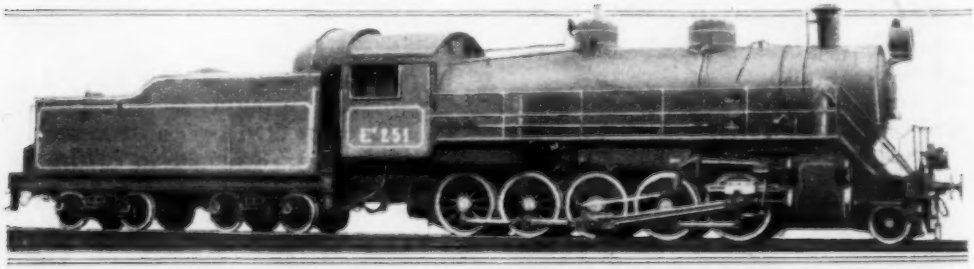
Twenty locomotives are being constructed at the New York plant of a large domestic company for the use of the Russian government on the Trans-Siberian Railway. As rapidly as they are assembled and tested they are taken down and shipped to the coast, from where they are transported to Vladivostok via Panama Canal and Japan. Each has a weight of approximately 316,000 lb. when in working condition and a wheel arrangement known in railroad parlance as "2-10-0." The cylinders are 25 by 28 in. in dimension, and the driving wheels 52 in. in diameter. Following the receipt of a rush order for these locomotives, work was commenced upon them June 26. The first of the number was completed August 13, a performance which came near being a record at the plant.

LIGHTING PLANT FOR MOVIE WORK ON MOTOR CAR

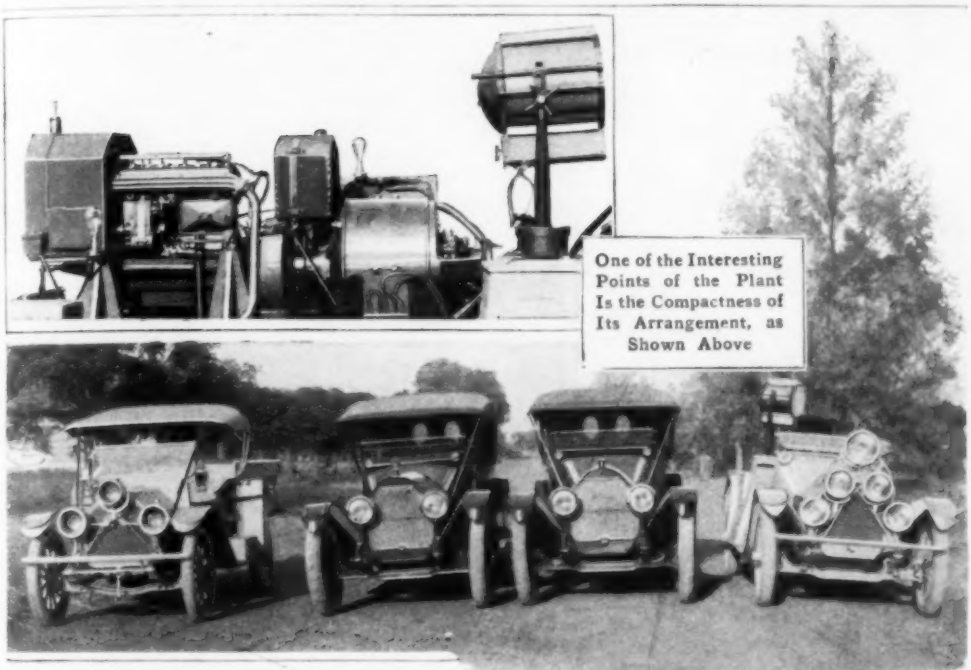
One of the large motion-picture producing companies has recently put in service a portable, high-power lighting plant which is being used in making photographs in caverns of the Grand Cañon and for night film work. The equipment is a new departure in the movie world and will allow the use of settings which otherwise would be impracticable from a photographic standpoint.

The plant is mounted on the chassis of a motor car and consists essentially of a 35-hp. engine, of the motor-car type, and a dynamo. A 12-in. navy searchlight of the projector type, capable of developing 4,500,000 cp., is fixed at one side of the driver's seat where it may be operated while the machine is in motion, if desired. At the front of the car is a battery of five power lamps.

With a 2,000-ft. cable it is possible



Type of Locomotives being Built in America for the Russian Government



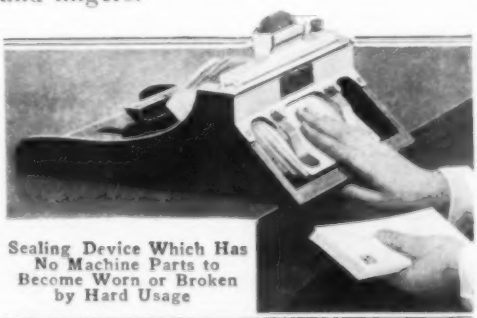
One of the Interesting Points of the Plant Is the Compactness of Its Arrangement, as Shown Above

This Shows the Battery of Cars Used to Carry Lighting Equipment, Photographic Paraphernalia, and Actors into the Grand Canon

to reach and adequately light places where it would be entirely impracticable to extend special transmission lines. A switchboard is installed so that wires may be extended to various points where lighting may be needed. Another car is provided which is fitted with compartments for carrying reels of film, cameras, and other equipment.

ENVELOPES SEALED QUICKLY WITH NEW DEVICE

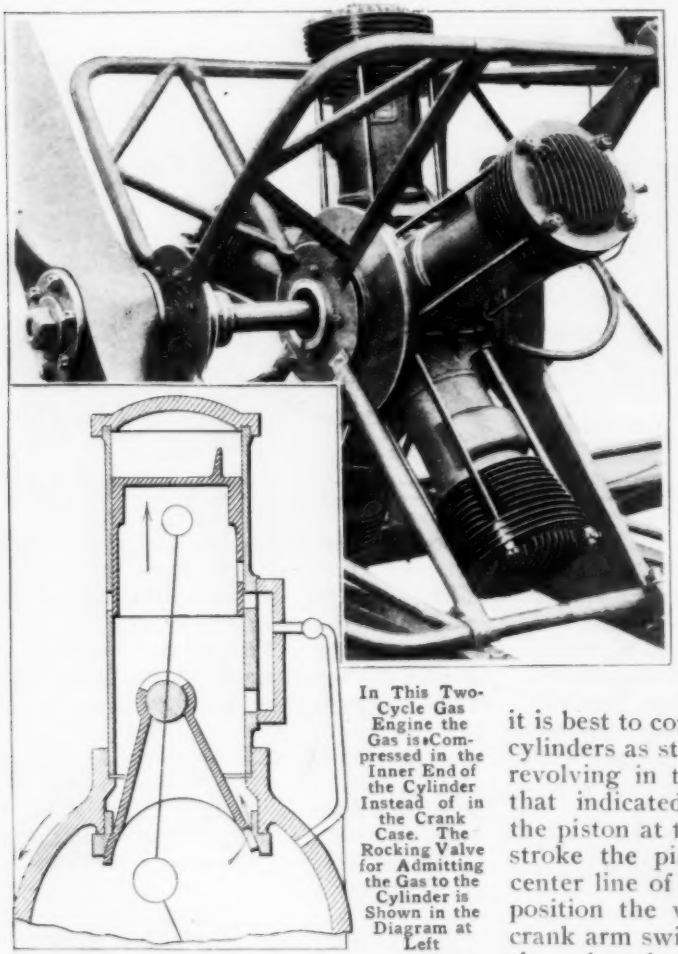
Simplicity in both construction and operation is the outstanding feature of a new envelope-moistening appliance which has been introduced as an office accessory. With the assistance of this device, which is quite compact and may be used on the top of a desk, it is possible to seal between 3,000 and 4,000 letters an hour. It receives both large and small envelopes, irrespective of the bulkiness of their contents. The device consists of a neatly finished wooden case in which the envelopes are placed with their flaps extended. The letters are pressed forward by a spring fixed to a follower at the back of the device. As an envelope is removed at the front by a quick downward movement of the right hand, the glue-faced surface of the flap is passed across a moistening wick which is supplied with water by a reservoir mounted at the top of the case. The letter is then sealed by placing it face up in the left hand between the thumb and fingers.



Sealing Device Which Has No Machine Parts to Become Worn or Broken by Hard Usage

NEW TWO-CYCLE ENGINE HAS COMPRESSION CHAMBER

An important innovation in gas-engine design that forms the principal feature of a two-cycle engine just invented and patented is an arrangement by which the gas is compressed in the inner end of the cylinder instead of being compressed in the crank case, as is the usual practice. Although adapted as well to making engines in which the cylinders are stationary, this novel feature is particularly intended for an aeroplane engine of the type in which the crank case and cylinders revolve about a stationary shaft. The gas, under atmospheric pressure, is admitted through the hollow shaft into the crank case, from which, without being compressed, it is admitted intermittently into the inner end of the cylinder through the action of a rocking valve that comprises the most essential detail of the invention. The valve consists in effect of two diverging plates joined together at one end to form a sliding bearing. It is so mounted that the junction of the plates is within the cylinder, while the free ends slide against opposite sides of the opening between the cylinder and crank case, one of the plates acting as a sliding valve and the other simply as a bearing. The piston rod works through the sliding bearing formed at the junction of the plates. This bearing is free to oscillate, so that the valve as a whole simply rocks back and forth with the piston rod. In the illustration the direction in which the crank case revolves is indicated by the arrow. To understand the action of the valve it is best to consider the crank case and cylinders as stationary and the shaft as revolving in the opposite direction to that indicated by the arrow. With the piston at the end of the downward stroke the piston rod stands on the center line of the cylinder, and in this position the valve is closed. As the crank arm swings to the left the top of the valve also swings to the left, with the result that the sliding valve portion at the end of the right-hand plate opens and remains open until the piston has nearly completed the upward stroke. In the meantime the gas is being sucked into the cylinder by the upward movement of the piston. When the piston reaches the end of the upward stroke the piston is again



In This Two-Cycle Gas Engine the Gas is Compressed in the Inner End of the Cylinder Instead of in the Crank Case. The Rocking Valve for Admitting the Gas to the Cylinder is Shown in the Diagram at Left

Artesian Wells Are Common throughout a Northeastern Michigan District: Nearly Every Farmer Has One or More of These Never-Failing Fountains on His Place

on the center line of the cylinder and the valve is closed. On the downward stroke the imprisoned gas is compressed, the valve being oscillated to the right and therefore remaining closed until the piston has started on the next upward stroke. As it reaches the extreme low position the piston uncovers the exhaust port, and, through the registering of the ports in the piston and cylinder, the gas is admitted through a by-pass into the working end of the cylinder. The engine is to be manufactured with three, five, or ten cylinders.

MICHIGAN'S FLOWING WELLS UNFAILING WATER SOURCE

In the yard before a rough log schoolhouse in a sparsely settled district in northeastern Michigan is an artesian well which supplies a constant flow of clear, cold water. The well is 101 ft. deep, and the water spouts to a height of about eight feet above the ground. This is typical of what may be found almost anywhere in this section of the state. Little difficulty is experienced in obtaining an adequate supply of water in the region. Many of the farmers have several artesian wells on their places, while in the various villages the community systems are supplied in the same way. Water is usually available at depths varying from 25 ft. to 200 ft. and in some places the pressure is sufficiently great to carry the water to the second story of buildings without the use of pumps. The water evidently comes from the rainfall over the great watershed, which practically insures its permanency. The steady increase in the drilling of wells has not had any noticeable effect upon the force of the respective flows, but attention is now being turned to the advisability of requiring that all bores be capped in order to conserve the supply to meet the demands which will be made when the country becomes more thickly settled.

HOT AIR INSTEAD OF TOWEL USED FOR DRYING HANDS

As an improvement upon the long-condemned roller towel, an electric toilet apparatus of novel form has been designed for installation in business and public buildings. The purpose of it is to obviate entirely the use of towels of any kind in such places and serve as a hygienic medium for drying the face and hands of its user. The general appearance of the device, which is finished in white enamel and surmounted by a mirror, is not materially different from many vending machines. A pedal at the base of the standard provides for the operation of the instrument, which throws out through an adjustable funnel at the front a steady draft of hot, perfumed air. Pressure exerted upon the pedal not only starts the machine but also adjusts the funnel to whatever angle is desired. The hands may be thoroughly dried in this manner in about 20 or 30 seconds. By bending close to the funnel, the face may be dried similarly.

MOTOR-CAR HEARSE BUILT AS LIMOUSINE ALSO

In order that his motor car might be made to serve two purposes, an eastern undertaker recently had a body designed which is convertible into either a hearse or limousine. Its lines are such that it may be used for either of these purposes without attracting particular attention or looking especially inappropriate. Instead of the long body appearing out of proportion when the car is used for pleasure purposes, it looks very roomy and comfortable. It is fitted with both side and rear doors, which obviously are employed according to the use to which the machine is being put. All of the hearse furnishings and fittings are so arranged that they may be easily removed, allowing rugs and upholstered chairs to be placed in the body of the car when it is desired as a limousine. The machine weighs 5,000 lb., has a wheel base of 134 in., and is equipped with a 4-cyl. 50-hp. motor. The body is built on a standard chassis.

This Car can be Quickly Transformed from a Hearse to a Pleasure Vehicle

The Arcade, Which Extends along the Entire Front of the Building, is Kept Well Lighted

DISPLAY CASES IN ARCADE REPLACE SHOW WINDOWS

During the alteration of a large building at Cleveland, O., a retail company which occupies the ground floor of the structure has continued business. The remodeling includes the construction of a new front, and, as is customary, a wooden inclosure has been erected over the sidewalk for the protection of pedestrians. In this instance, however, the structure has been built in the form of an airy arcade instead of a dark passage with solid walls on either side. In order to counteract the effect of losing its display windows during the building operations, the company has placed a series of shallow show cases along the inner wall of the temporary structure. These are well lighted, serving as good substitutes for the regular windows and relieving the store of what otherwise would be a boarded-up appearance.

KITCHEN CABINET CLOSES LIKE ROLL-TOP DESK

In constructing an adjustable kitchen cabinet, the work table of which may be raised or lowered to suit the convenience of its user, the sliding curtain of the roll-top desk has been employed in an interesting way. By using this means of inclosing the case, the possible objection to swinging doors has been overcome. It is divided into three general compartments, each of which is screened by a wooden curtain that may be rolled entirely out of the way when access to one of the spaces is desired. This likewise does away with the use of glass, which is always subject to breakage, especially when moving is undertaken. A small ironing board, a composition top, and special glass receptacles for sugar, coffee, salt, and spices are other serviceable features of the cabinet.

Kitchen Cabinet with Adjustable Table and Roll Doors

DANGER AT HAIRPIN TURN LESSENED BY ROAD GLASS

In several foreign countries the use of road mirrors has proved very helpful to motorists and has apparent-

The Mirror Serves Just as Effectively at Night as It Does in the Daytime

ly done much to avert accidents at view-obstructed crossings and dangerous turns. This same idea has been employed to lessen the danger at a hairpin turn in a much-traveled road in western Pennsylvania. An automobile club has erected a large mirror at the crest of a ridge where this road has a bad turn and a steep grade on both approaches. The glass has been mounted in such a manner that it gives a motorist a view around the curve, regardless of his direction of travel. It is as effective at night when the glare from the headlights of approaching cars is reflected, giving warning and showing the relative positions of the machines.

LIFTING TIMBER OVER THE ARROWROCK DAM

In the basin of the Boise River, above the Arrowrock dam in Idaho, there is approximately 3,000,000,000 feet of merchantable timber, estimated to be worth about $36,000,000 when made into lumber, all of which eventually will be cut and taken down the river to sawmills near Boise. The river furnishes the only practicable means of getting the timber out. This involves taking the logs around or over the Arrowrock dam, and delivering them in good condition in the river below. In this requirement a knotty problem was presented, as it is necessary to handle the logs not only economically but without the possibility of damage to the dam. This problem has been solved by the construction of an apparatus that is capable of handling 60,000,000 ft. during the 60 days of each summer when the water is 45 ft. or less below the top of the dam. At this rate it will require 50 years to transport the entire 3,000,000,000 ft. past the dam if this method alone is used, and since the equipment will doubtless be in service for a great many years in any event, it is being built of the best of concrete and steel. This equipment is located at the extreme south end of the dam. With it the logs will first be taken out of the reservoir by means of a cable lift and deposited on a concrete deck on the top of the dam. From this deck they will be fed, one at a time, by a stop and loader to power-driven spiked rolls which will take them across the dam and deliver them to a bull chain which is provided with sp rs or teeth to prevent the logs from sliding. This chain will take the logs at a speed of 85 ft. a minute down a slope having a fall of 62½ ft. to 100 ft. and will finally deposit them in a gravity chute through which they will slide into the river be-

low. Power for operating the equipment is to be supplied for the present from a diversion dam located 12 miles downstream, but a power plant for this purpose is eventually to be built immediately below the Arrowrock dam.

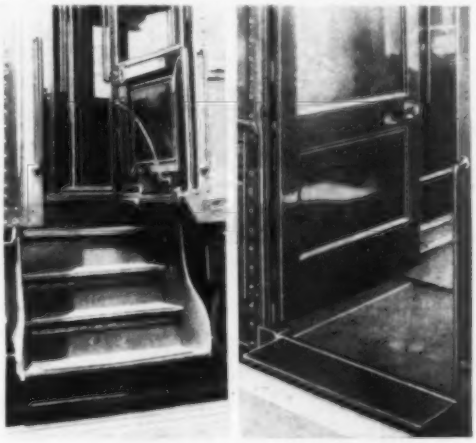
POCKET DEVICE SUBSTITUTE FOR CAMERA TRIPOD

When he is without a tripod or an adequate substitute for one, an amateur photographer often experiences difficulty in finding a means of holding a camera while making a time or bulb exposure. To obviate this and also do away with the trouble of carrying a tripod, a New York inventor has designed a folding device, small enough to be slipped into a vest pocket, which may be secured to a tree, or some other convenient object, to support a camera. It has two sharp prongs which, when pressure is applied against a small lever, fasten themselves in the bark of a tree or in other wooden objects against which they are set. A friction clamp attached to this holds the camera. By folding back the prongs and employing another fastening medium which is provided, the same device may be fixed to a stone or metal surface or to polished furniture.

By Pressing a Small Lever the Prongs Fasten Themselves into Any Wooden Object

AUXILIARY PLATFORM LEAF FOR PASSENGER CARS

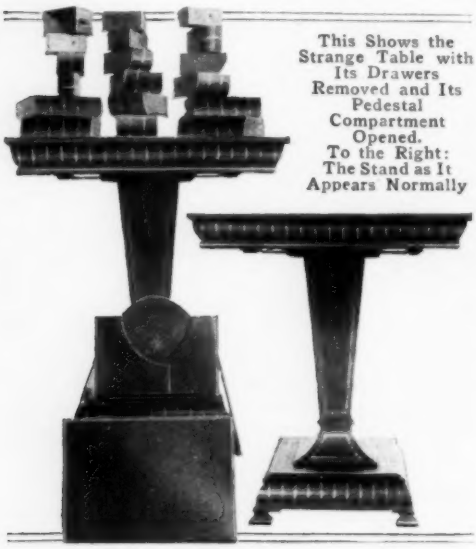
One of the eastern railway companies has equipped a steel vestibule car with extensible trapdoors for experimental purposes. At a number of its terminals it has constructed high station platforms. The convenience and object of these are obvious, but a difficulty arises in using them when it is necessary that they be constructed on a curve, for in such instances a gap occurs between the flooring and the cars. It is frequently impossible, because of the physical conditions at many of the stations, to build a raised platform on a tangent. The extensible trap which is now being tested is designed to overcome this objectionable situation by bridging the open space between the car and the platform when the outline of the latter is curved. This is arranged so that the sliding member is moved into position by the opening of the vestibule door. When the door is closed, preparatory to the departure of a train, the leaf is simultaneously withdrawn. A control handle in the vestibule permits the disengagement of a gear which makes it possible to open the door without actuating the leaf, when this is desired.



When Extended by Opening the Vestibule Door, the Auxiliary Leaf Bridges the Gap between the Car and a Station Platform. A Means is Also Provided for Opening the Door without Actuating This Mechanism, So That the Steps may be Used

SOLID-APPEARING TABLE HIDES MANY DRAWERS

After 10 years of planning and painstaking work, a Medford, Mass., carpenter has constructed a small table



This Shows the Strange Table with Its Drawers Removed and Its Pedestal Compartment Opened. To the Right: The Stand as It Appears Normally

which contains some 29 secret drawers. It is built of mahogany inlaid with walnut, ebony, and boxwood, and, as far as its outward appearances are concerned, is intended as a game board for cards, chess, and checkers. A series of hidden buttons set beneath the top provides access to the various compartments. These are so ingeniously concealed that a scrutinizing observer would in all probability miss the significance of the table unless he discovered the operating buttons. Beneath the checkerboard top are a number of compact drawers in which cards, chessmen, and chips may be kept. Each of these is reached by pressing a separate button which releases a spring and opens the desired compartment. Drawers are secluded in all sides of the table, in the top and the pedestal. Besides the 29 of these there are two shelves, five covers, and one door. The available storage space amounts to 1,288 cu. in. The stand is 2 ft. 2 in. square and of normal height. It offers a good hiding place for household valuables.

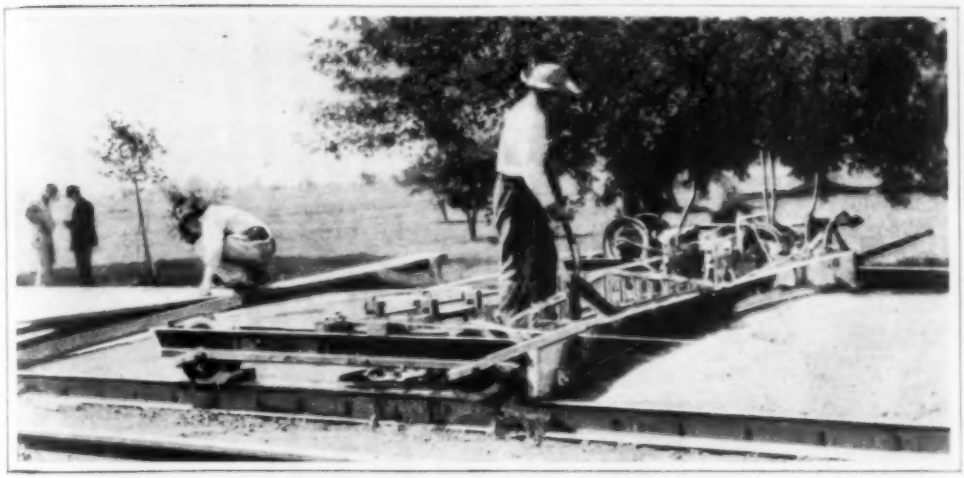
INTENSE HEAT DEVELOPED BY NEW GAS BURNER

Very high temperatures have been attained with a gas burner lately designed by a St. Louis inventor, in which combustion takes place, as it does in the cylinders of gasoline engines, within an air-tight chamber. The flame is not subjected to the cooling effect of a surrounding atmosphere of secondary air and the heat units are thus conserved. The burner is made in the form of a cylinder having an upper and a lower chamber, the latter of which consists of an air mixer. The mixture ascends into the chamber above, passing through a perforated disk, or burner, which divides the compartment horizontally. A shutter, provided in the combustion chamber, is opened only when it is necessary to ignite the gas. As is true of any such burner, the heat is regulated by the flow of gas and the amount of primary air entering into the mixture. The burner is especially adapted for domestic water-heating apparatus. The

The Various Parts of the Device are Shown and Identified at the Left, While at the Right Is the Burner Assembled

supply pipe leading to a tank is encased in a 2½-in. tube into which the flame of the burner is directed.

¶A submarine base for the United States Navy is probably to be established at New London, Connecticut.



The Apparatus Works Rapidly and Effects a Saving in Labor

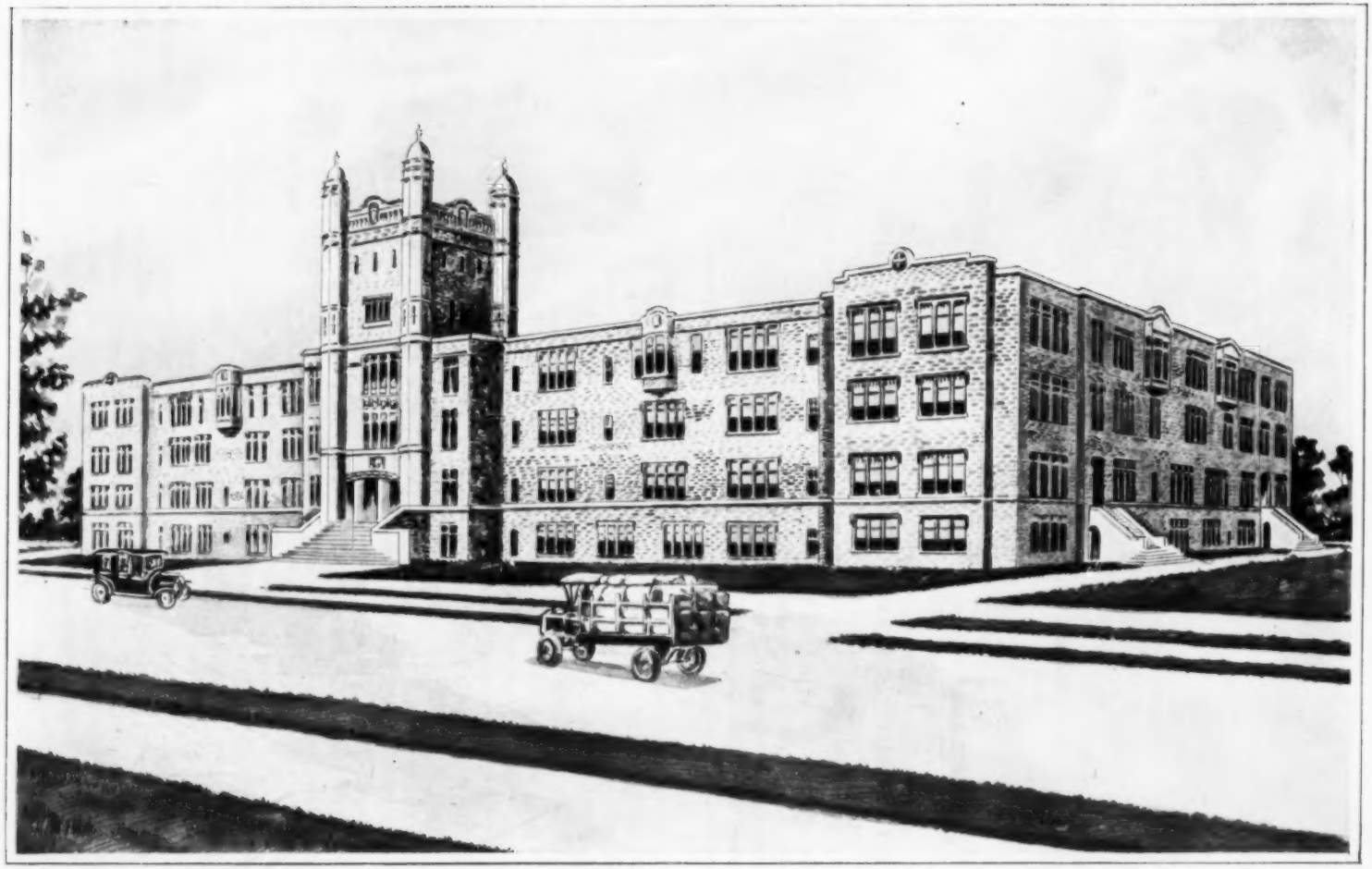
MOTOR-PROPELLED FINISHER FOR CONCRETE ROADS

For saving labor in the construction of concrete roads and bases for street pavements, a motor-driven template has been invented which is capable of working approximately 500 feet of 16-ft. roadway a day. The apparatus is carried on car wheels which roll along the tops of steel forms used to hold the mixture in place. At one side is mounted a gasoline engine which provides the propelling power and also imparts to the template a reciprocating motion which expedites its work. At the rear the contrivance is designed to serve as a smoothing tool. Only two persons are required in operating it. One rides the machine, watching the template plank and also filling in low places, while the other follows up the work, mending small defects in the surface of the concrete.

TELEPHONE METER IS MADE IN VERY COMPACT FORM

By making use of an ordinary watch movement, a telephone meter has been invented which is intended to perform much the same function as does an electric-light or gas meter. The device is fitted inside of a receiving instrument. When a button, fixed in the side of the latter, is pressed, the meter is wound and started. Until this is done communication over a line is prevented. At the expiration of a specified period, the meter automatically cuts off a conversation, making it necessary to again push the button, and thus reset the timer, if further use of a line is desired.

¶An American neurologist, recently returned from Europe's battle fields, asserts that thousands of soldiers are being made incurable idiots by the rupture of their nerve trunks and centers. This is due to the terrific explosions of large shells.



The New Central Technical School of Toronto, Canada, Which When Fully Equipped will Represent an Investment of Nearly $2,000,000

LARGE TECHNICAL SCHOOL BUILT AT TORONTO

On account of the constantly increasing demand by young men and women of Toronto, Canada, for elementary technical training as well as vocational and domestic instruction, the city has expended nearly $2,000,000 in erecting and equipping one of the largest and best appointed industrial schools in North America. This institution, which is known as the Central Technical School, is now practically completed and will be able to accommodate approximately 2,500 day pupils and 5,000 night attendants.

The building is constructed of stone, is four stories in height, and has seven acres of available floor space. Its 320 rooms are divided principally into shops, laboratories, study and recitation rooms, and lecture halls. It is provided with a large gymnasium, a natatorium, adequate locker rooms, and an auditorium with individual seats for 1,300 persons.

A staff of 150 instructors has been engaged to carry out the educational work. These men and women will have charge of courses which will include everything from lace making, cooking, and art work to bricklaying, steam fitting, and architecture. Aside from ordinary high-school subjects, metallurgical work, casting, forging, electrical construction, painting and decorating, printing, carpentering, wood carving, machine and topographical drawing, sewing, millinery, and a myriad of other things will be taught.

For day pupils, four-year courses in industrial subjects for boys, and three-year courses for girls, are to be given. One-half of the time in the last two years of each course will be spent in actual shop work. There will be courses in applied science and household science, to which only pupils qualified to enter high school will be matriculated. In addition to these there will be special short courses in theoretical and practical technology as well as instruction in fine and applied arts adapted to different industries.

Every possible means of extending help to the night and part-time pupils is to be used. Practical demonstrations will be given by skilled workmen in industrial courses, to which only those who are engaged in that occupation will be admitted.

The new school is the central one of a group of similar, but smaller, schools.

TOWN ATTRACTS MOTORISTS IN NOVEL MANNER

Laconner, a little town in Washington, is situated some distance from one of the state highways used by many motor tourists. It boasts, however, a lone hill which commands the best view obtainable of Skagit Valley, one of the rich farming districts of that section. In order to draw the passing tourists from their beaten path and attract them to Laconner for the advantage of local business, the community has constructed a winding road to the summit of the hill and there built an observation stand. To advertise the lookout point, the words "Auto View"

By Providing a Lookout Point for Motorists, Laconner has Commercialized Its Only Hill

have been painted in letters 8 ft. high, on the wall of a water reservoir at the hill's crest. This sign is sufficiently large to be seen for a long distance.

¶ Promoters of the San Francisco fair have announced that the enterprise is now free from debt.

AUTOMATIC RAKING MACHINE FOR LAWNS

Everything, from small leaves to newspapers, may be picked up from the lawn rapidly by means of a self-cleaning lawn rake that has just been invented and patented. This machine looks much like a lawn mower. The teeth extend from the front to the rear and are mounted in a sloping position so that their curved forward ends touch the ground. As the material is picked up it is drawn backward along the teeth and deposited in a carrier at the rear by an endless belt which runs on rollers mounted at the front and rear of the machine. The rear roller, and through it the belt, is operated by a pinion worked by one of the wheels.

Through the Action of the Endless Belt, Rakings from the Lawn are Carried along the Teeth and Deposited in the Carrier at the Rear

SUGAR-FACTORY WASTE USED AS MOTOR-CAR FUEL

Experiments are being conducted in Great Britain with a new fuel for motor cars which apparently gives greater power than gasoline. It is an alcoholic mixture obtained from the waste products resulting in the refining of sugar and has a specific gravity of .800. The liquid was recently tried in an aerial motor of 100 hp., which it turned over at a speed of 1,450 revolutions a minute. Gasoline drives the same engine at only 1,250 revolutions a minute. Alcoholic mixtures have a common fault in that they are prone to cause corrosion in the cylinders should combustion be incomplete. To offset this an alkaline ingredient is introduced which neutralizes the acid properties of the new fuel. For six months the product has been used exclusively in a testing car with satisfaction.

ADDING MACHINE OF ENORMOUS CAPACITY

What is undoubtedly the most remarkable calculating machine in existence has recently been constructed and is capable of adding figures totaling within one unit of ten duodecillions. While it is hard to conceive its ever being used to more than a millionth of its capacity, it is also capable of subtracting, dividing, and multiplying in duodecillions. In other words, the machine is able to handle 40 columns of figures at one time. A practical use for it comes in its ability to add several different sets of figures simultaneously without confusing their totals. This allows it to accomplish what otherwise would require the services of from six to ten instruments of ordinary capacity. The machine is 33 in. wide, but weighs only 35 pounds.

Huge Adding Machine Compared with One of Ordinary Size: The Capacity of This Machine Is So Great That It Is Doubtful Whether It Will Ever Be Called Upon to Do More than One-Millionth of What It Is Capable

MEETING WAR'S EMERGENCIES WITH INGENIOUS INVENTIONS

By SEARLE HENDEE

SINCE Europe has been merged in hostilities, scarcely a month has passed unmarked either by the development of some new agent of destruction, or the introduction of some new medium of defense. The creative genius of half the world has been concentrated in an effort to make war more terrible on the one hand, and safer on the other. And first one belligerent and then the other has met crucial emergencies by ingenious, not to say startling, inventions.

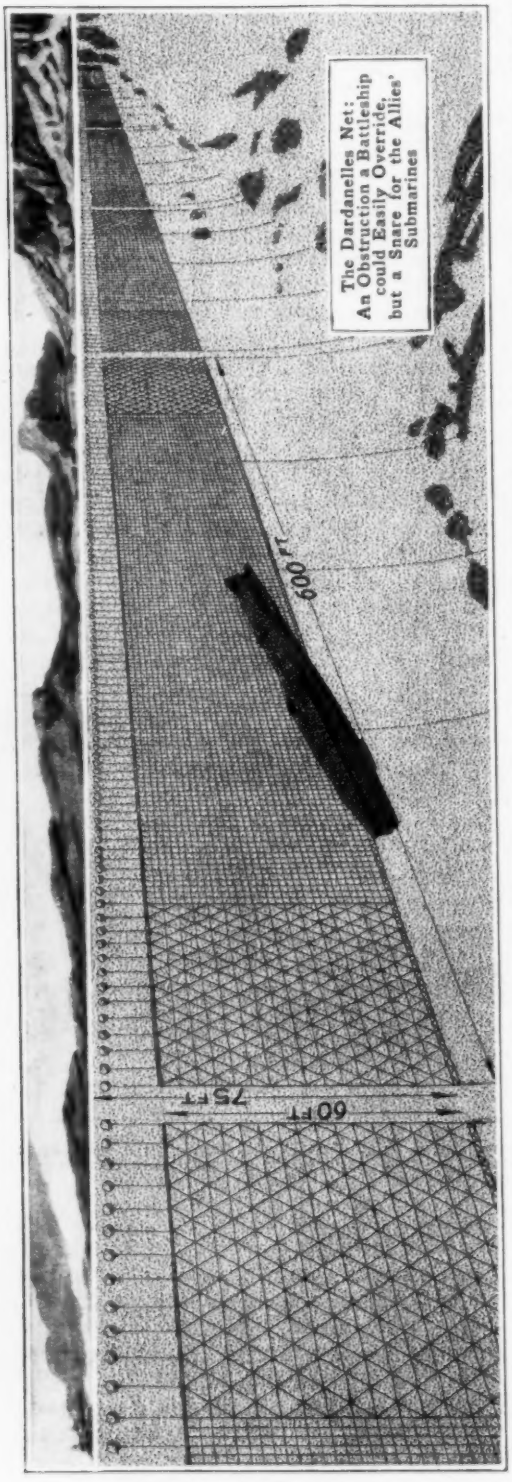
The apparent deadlock on the western frontier has presented a perplexing situation. For months the armies have fought battles more sanguinary than Waterloo without making progress except in terms of yards. Trench warfare has been responsible for this. Any kind of an offensive movement has meant heavy losses.

To make the trench less secure for the enemy is an object which each of the belligerents is striving to accomplish. A step in this direction is found in the work of a British inventor who has developed a wheeled body shield that affords immunity from rifle bullets and shrapnel when advancing upon fortified positions. The body of this is constructed of tempered-steel plates, the front so rounded and tempered that bullets strike the surface at an angle and glance off without doing harm. The rear is open, while the interior is just large enough to accommodate one soldier, who rests on his hands and knees. The device is propelled forward by pushing against the ground with one foot. A long slit in the front part terminating in a porthole forms a lookout for the soldier and also a loophole through which to fire. When within a few yards of an objective point the fighter leaves the armored shell and charges in the usual way.

It was inventive skill applied in a different channel that made possible the construction of a gigantic steel network across the Narrows in the Dardanelles to check the operations of the allies' submarines in the Sea of Marmora. The barrier extends some 75 ft. beneath the water and is long enough to block the entire channel from Chanak Kalessi in Asia Minor to Namazieh on the European side. It is composed of a number of great nets, each approximately 600 feet long, moored end to end by means of buoys and anchors. The middle portions of the units consist of torpedo nets from German and Turkish battleships, while the buoys were taken from the Sea of Marmora and the Black Sea where they had been used to aid navigators. Attached to both ends of these members are heavy nets of 5-ft. tri-

The Wheeled Body Shield in Use: This British Invention Is the Latest Scheme Developed for Protecting Infantrymen during Offensive Operations against Enemy Trenches

angular mesh, made of ⅛-in. iron wire. Interlaced over the whole of the latter sections are reinforcing skeletons of Manila and wire cables, woven in 30-ft. squares. The units are bound by heavy cables fixed at the top and bottom, and to these the anchor and buoy chains are secured. The former are placed at intervals of 120 ft., while the buoys are but a short


The Dardanelles Net:
An Obstruction a Battleship could Easily Override, but a Snare for the Allies' Submarines
600 FT
75 FT
60 FT

distance apart. The nets are suspended perpendicularly and reach within 100 ft. of each shore line, or to water too shallow to float a submarine. The open spaces intervening between the nets are not sufficiently great to permit the passage of a submersible.

The British submarines have not been entirely blocked by the net, although their activities have been hampered. The French submarine "Mariotte," however, was caught in the trap early in August while attempting to dive beneath it. Most American undersea boats are capable of submersion to a much greater depth than 80 ft.—which is necessary to pass beneath the barrier—but the rumor is current that the British and the French crafts leak badly when the feat is undertaken. When the "Mariotte" attempted the dive it took water so fast that its commander was forced to rise, and in so doing the starboard diving plane fouled the net, entrapping the vessel, which was almost immediately captured by a Turkish patrol boat.

At the beginning of the war there was a deep-rooted belief that the submarine was destined to banish dreadnaughts and battleships from the seas. Except for the attacks upon merchant vessels by German undersea craft, which have been negligible so far as real military value is concerned, the submersible has done very little of especial importance. This represents a striking case in which inventive genius has met one of war's serious emergencies. The submarine has become as vulnerable a boat as any afloat. Inventions, of which the Dardanelles net is but one example, have been responsible for this changed condition.

The net across the Narrows has been a practical means of defense because there is little tide in the eastern Mediterranean to disturb it. This condition is not true in the waters about England, where a different scheme has been used by the British admiralty with remarkable results. It has been repeatedly stated in press reports that in a period of about two months following the first week in May, Ger-

many lost more than 60 submarines, among which were listed the "U" boats Nos. 2, 4, 5, 7, 9, 15, 16, 18, 22, 23, and 24. This, it is claimed, has been accomplished by literally seining the

Batteries of Rifles Mounted on the Trench Parapets are Fired by Pulling a Rod Extending through the Trigger Guards. This Is France's Ingenious Substitute for Machine Guns

boats. The nets used for this are made in lengths of about 170 ft. with heavy iron wire. They are usually about 27 ft. in width and of 15-ft. mesh. When in use they are stretched between the bows of two oil-burning destroyers and buoyed by means of large blocks of wood attached to the binding cables along the top. When an enemy submarine is sighted, the fast destroyers cut ahead of the vessel and moor the net directly in the path it is pursuing.

The rough condition of the water in the North Sea greatly restricts the range of a periscope, making it effective for a distance of only about a mile. This permits the destroyers to set the trap, after observing the course a submarine is taking, and escape unnoticed. The result is that the submersible proceeds, ignorant of danger, and drives its nose into the netting, the top of which is about eight or ten feet beneath the surface.

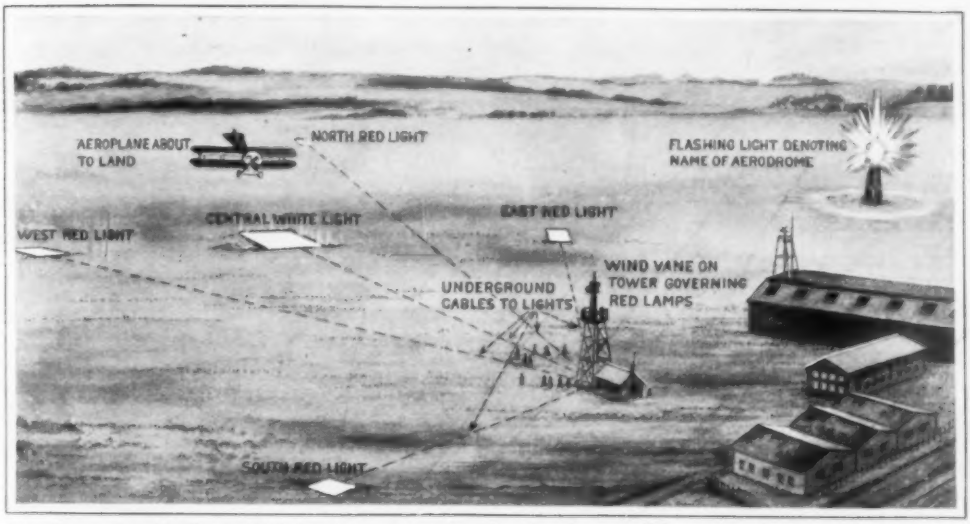
More surprises in the way of new death-dealing and defensive machines have been introduced on the battle fields, however, than at sea. Machine guns have played a more important part in this war than ever before. These implements are very expensive and in no case is any of the armies supplied with as many of them as it could use. The French, however, have overcome their shortage by a most clever makeshift. By utilizing the rifles of dead and wounded soldiers, they have constructed a very ingenious and quite satisfactory type of "machine gun." The weapons are set in rows in wooden frames mounted on the parapets of the trenches. Frequently as many as 20 guns are grouped in one of these batteries. By pulling a rod placed through the trigger guards of the rifles in each tier, all of the pieces are discharged at one time. By using the magazine fire,

about 40 bullets can be shot from a modern army rifle in one minute. This explains how such a battery of guns can discharge from 600 to 800 shots a minute, which is equivalent to the work of a machine gun. The loading requires more time than that of a machine gun, but the firing itself is just as rapid.

When the Germans commenced fighting with poisonous gases in the western war zone it required only a short time for the allies to equip their soldiers with respirators, and install warning signals in the trenches. These agents practically neutralized the effectiveness of this means of fighting. A further defense against asphyxiation has been suggested, however, which shows how truly the war is a conflict of wits. The use of gas depends upon there being a gentle breeze to carry the fumes to the enemy's positions. A strong wind is as useless for this purpose as is a calm. The new plan is to combat the gas clouds with counter air currents, just as our western pioneers once fought prairie fires with fire. This it is proposed to do by installing a series of fan blowers in the advanced trenches to create updrafts and raise the vapor clear of the lines. These, when operated by hand, would be placed at intervals of 10 or 12 feet, and connected with large pipes extending through the base to the front of the earthwork. The spaces between the units would be increased when large, motor-propelled fans were installed. Anyone who is familiar with the blowing force of an aerial propeller, will readily appreciate how effectively a scheme of this kind might be worked out.

Ingenuity of a much different character has been shown by the Germans in connection with their aerial activities. Before hostilities commenced, night aeroplane flying was not practiced to any extent. A few months of war showed, however, that the flying machine could accomplish much under the cover of darkness that it could not attempt without extreme hazard in the daytime. One of the greatest problems encountered by a pilot at night is that of landing safely. To ameliorate this condition the Germans have devised lighting systems for their army aerodromes which assist airmen in alighting after nocturnal voyages. A powerful white light is installed in a large pit dug in the middle of a field and covered with heavy

Rotary Blowers, Operated by Hand, Installed in an Advance Trench to Lift the Clouds of Deadly Gases Used by the Germans. This Plan has Recently been Proposed by the British


AEROPLANE ABOUT TO LAND
NORTH RED LIGHT
FLASHING LIGHT DENOTING NAME OF AERODROME
EAST RED LIGHT
CENTRAL WHITE LIGHT
WEST RED LIGHT
WIND VANE ON TOWER GOVERNING RED LAMPS
UNDERGROUND CABLES TO LIGHTS
SOUTH RED LIGHT

This Shows Graphically the Lighting Arrangement Employed at German Military Aerodromes to Assist Airmen in Landing without Accident after Terminating a Reconnaissance Flight, or Aerial Raid, at Night

plate glass. Surrounding this central light, at distances of about 250 ft. from each corner of the pit, and corresponding to the cardinal points of the compass, are four red lights similarly fixed in the ground. These are controlled by a switch working in connection with a wind vane. When a red light shows at the east of the field, the aviator knows that the wind is blowing in that direction. As he approaches an aerodrome he signals the attendants by flashing a revolver. The lights are then turned on, the big white glow indicating where to land and the relative distance to the ground, while the red patches announce the direction of the wind. He turns the nose of his machine toward the white light and glides to the earth, avoiding the dangers of being caught by a side wind or misjudging the distance.

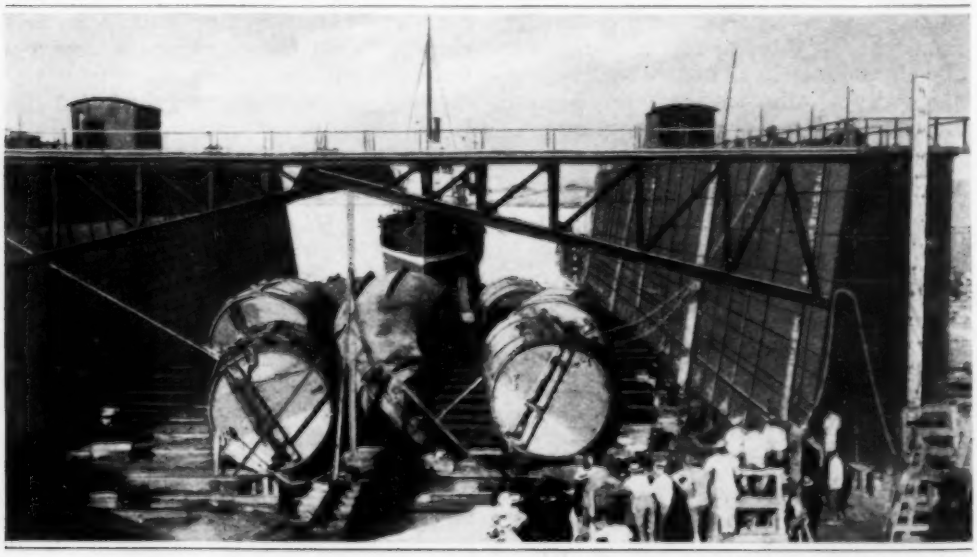
These illustrate a few of the numerous ways in which the war's emergencies are being met. For every new instrument of destruction introduced, some means is promptly developed to counteract its effect or nullify its efficiency. And for every fresh obstacle encountered in the ever-changing methods of war, some scheme is devised for surmounting it.

HOW THE SUNKEN SUBMARINE "F-4" WAS RAISED

After five months of practically continuous work under extremely trying conditions, the submarine "F-4," which with a crew of 22 men on board had failed to rise following a dive in water 300 ft. deep outside the harbor of Honolulu, was raised to the surface and on August 30 was placed in dry dock. The raising of this vessel is by far the most remarkable feat in ship raising ever accomplished. In the early stages of the work all records in deep-sea diving were broken, five descents being made to a depth of 306 ft., and eight to a depth of 275 ft. The first efforts made toward the recovery of the submarine consisted in grappling with looped steel cables in an attempt to drag the vessel into shallow water. When, however, the snapping of line after line proved that the submarine was completely waterlogged, this method was abandoned for that of lifting with cables suspended from mud scows, the dragging operations having definitely indicated the location of the

sunken vessel. The scows, of which two were used, were 134 ft. long, with a beam of 36 ft. and a depth of 13 ft., and were equipped with vertical wells. Through these wells the steel lifting cables, each 2½ in. in diameter, were operated by means of shafts, 16 in. in diameter, mounted on horizontal bearings. To rotate the shafts, spools having a diameter of between four and five feet were fitted to the ends, and cables wound around these were unwound by steam power as required. The dead weight to be lifted was about 250 tons. Four slings were used, the loop of each sling being swept under the hull and the ends led up to the surface and fixed to the shaft. When the actual work of lifting began, a new trouble developed, the chafing under the keel of the submarine causing line after line to break. Chains, 2½ in. in diameter, were then spliced into the loops of the slings to take the chafe of the keel and the work of lifting proceeded without further mishap. At the end of each day's work the scows were towed inshore until the submarine grounded, and by this method the vessel was finally grounded close to shore in water only 50 ft. deep. Inspection by divers showed the condition of the vessel to be such that it would be unsafe to lift it to the surface by the chains, and pontoons were therefore substituted. These pontoons, of which there were six, consisted of steel cylinders which were sunk alongside the submarine and slung to it by means of chains. While being sunk, the cylinders were filled with water, the water being later forced out by compressed air. After the vessel had been docked, an examination showed two large holes, one at the bow and the other at the stern, while the bottom and starboard were found to be filled with sand, mud, battery plates, and other debris. At that time no definite cause for the disaster to the vessel could be discovered. There were indications, however, that the crew had been asphyxiated by chlorine gas generated by the leakage of sea water into the cells of the storage batteries, and that the holes in the hull had been caused, after the death of the crew, by the pounding of the vessel on the sea bottom.

¶ While making more than 16 miles an hour the battleship "Wyoming" recently took on oil from the collier "Cyclops" by means of a pipe extended between the two vessels.



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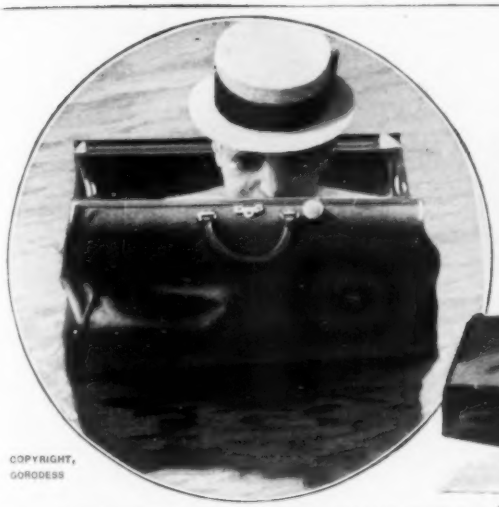
The Submarine "F-4" as It Appeared after being Raised and Placed in Dry Dock: The Steel Cylinders alongside the Vessel Are the Ones Used for Making the Final Lift to the Surface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The Top Floats Well above the Water and It Is Safe to Open It in a Calm Sea

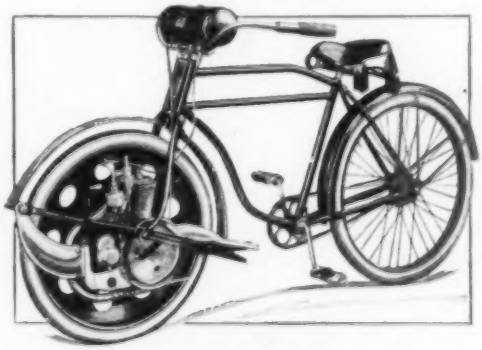
This Traveling Bag Has a False Bottom Which is Removed to Convert the Bag into a Life Preserver

COMBINED LIFE PRESERVER AND TRAVELING BAG

Designed not only to look like an ordinary traveling bag but to be used as one under ordinary conditions, a life preserver that has just been invented apparently provides a sensible solution of the problem of safety at sea in time of sudden emergency. The bag is equipped with a false bottom that serves to hold in folded position a water-tight union suit which is attached in such a way that the bag and suit act as a water-tight unit. In an emergency all that is necessary is to dump out the contents of the bag, remove the false bottom to let the suit unfold, and get inside. The user then closes and locks the top over his head and jumps into the water, the required buoyancy being supplied by the bag. The body of the bag is equipped with a window and with valves that admit air but not water. Inside, there is space for storing food and water sufficient to last several days. To prevent disaster in case the water-tight suit is punctured, an air-tight bag that is easily inflated is installed inside the traveling bag. Since the top floats well above the water it is safe to open the bag in a calm sea.

NOVEL POWER-DRIVEN CYCLE OF SIMPLE CONSTRUCTION

Several interesting features are embodied in a light-weight, power-driven bicycle which was introduced at the recent Chicago motorcycle show. It is built especially for the person who needs an efficient and comparatively inexpensive conveyance of very simple construction. The power plant consists of a 1½-hp. motor mounted in the front wheel, which is made of pressed steel. A gas tank of 1-gal.

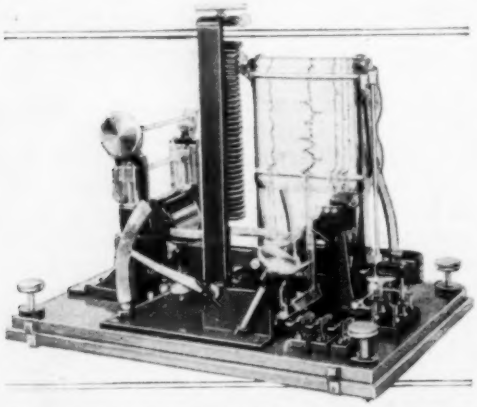


The Weight is Distributed Equally, since the Front Wheel Carries the Motor and the Rear One Supports the Rider

capacity, sufficient for 100 miles, is clamped to the handlebars. The front wheel is flexibly attached to a three-stem fork and directly connected with the motor by means of a compensator. The advantages cited for the driving arrangement are that the weight of both the rider and engine is equally distributed, and the vibrations of the motor are not communicated through the frame. The mounting of the motor within the wheel is worked out as it was in the auxiliary power wheel for bicycles brought out some time ago. A speed range of from 5 to 25 miles an hour is provided. The cycle has a wheel base of 43 in. and weighs 115 pounds.

INSTRUMENT REVEALS CAUSE OF SHIP'S VIBRATIONS

A new instrument for the investigation of vibration in ships has just been brought to such a stage of development that it is being installed at the model basin, Washington, D. C., for the use of the engineers of the United States Navy. This instrument is known as the pallograph. It records both vertical and horizontal vibrations, and while intended mainly for use on board ship, it may be used to trace vibrations of any character to their source. The first pallograph was invented shortly before the ill-fated "Lusitania" was launched and was used successfully in discovering the cause of excessive vibrations in that vessel. The instrument just brought out is so made that it is not affected by any regular or periodic motions of the ship such as rolling and pitching. It is equipped with a time marker indicating seconds, and in addition to recording the vibrations of the ship, it indicates the revolutions of the ship's shafts. The record is made on a paper strip which is moved at a constant speed by a small motor, means being provided for regulating the speed from ⅝ in. to 1½ in. per second. The instrument weighs only 90 lb., and is 24 in. long, 14 in. wide, and 20 in. high.



New Instrument with Which the Smallest Vibrations of a Ship are Recorded and Traced to Their Source

MID-OCEAN SUNSET NOT SEEN BY SAN FRANCISCO AIRMAN

On page 598 of the October number of Popular Mechanics Magazine appeared an article claiming that an airman at San Francisco had viewed a mid-Pacific sunset from an elevation of 6,000 ft. Through some mischance this statement, obviously in error, escaped editorial vigilance, and was printed before it was observed. A calculation of the angular distance to the horizon from an altitude of 6,000 ft. — assuming the earth's radius to be 4,000 miles, and its circumference on any great circle, 25,000 miles—shows it to be approximately 1⅓ degrees, which corresponds to a little over 92 miles. What the airman took for a sunset must therefore have been some afterglow or reflection against a cloud of light far below his horizon.

¶By painting periscope tubes with parallel stripes representing the colors of the spectrum, it is reported the Navy Department hopes to make these members of submarine craft invisible to an enemy. It is thought that when refracted the colors will appear as a white ray, practically indistinguishable at a distance.

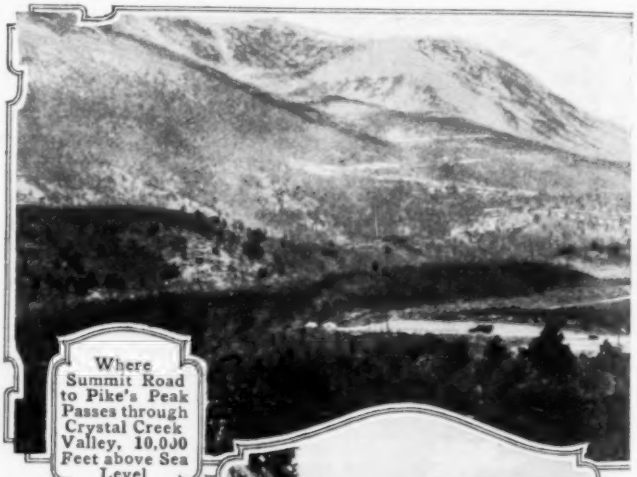
NEW YORK STREET CAVED IN BY SUBWAY BLAST

PHOTOS COPYRIGHT, INTERNATIONAL NEWS SERVICE

A DYNAMITE blast at Twenty-Fifth Street in the Seventh Avenue subway, under construction at New York, recently caused an entire block of the thoroughfare to collapse. The timbers supporting the roadway were dislodged by the explosion, and a crowded street car, a motor truck, and many pedestrians were precipitated into the 30-foot excavation beneath. Seven persons were killed and about 100 others injured. The photographs show the rescue work in progress.

MOTOR ROAD TO THE SUMMIT OF PIKE'S PEAK

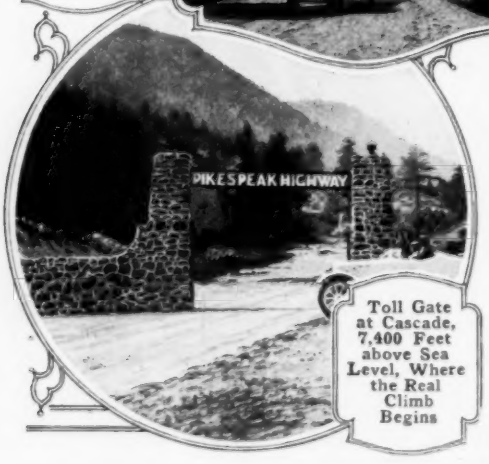
MOTORING into and above the clouds is a novel and fascinating feat made possible for the tourist by the completion of the new motor road to the summit of Pike's Peak. In the operation of the road the trip to the summit will ordinarily be made from Colorado Springs, the route leading through the Garden of the Gods, through Manitou, and up Ute Pass to Cascade, which is on the edge of the Pike National Forest and is the point where the new road begins. Cascade is located about 12 miles west from Colorado Springs. From this point the road passes through some of the finest scenery in the West, and after 17 miles of winding and doubling through the cañons and along the mountain sides, it reaches the summit of the mountain 14,109 ft. above sea level. The road skirts many of the best-known scenic features of this section of the Rockies, such as Crystal Creek Valley, perched 10,000 ft. above sea level, and Lover's Leap, a precipice having a sheer drop of 2,000 ft. It is estimated that from the summit something like 30,000 square miles of the earth's surface is visible, the view extending over a hundred miles to the east, and including to the west scores of peaks that are covered with perpetual snow.



Where Summit Road to Pike's Peak Passes through Crystal Creek Valley, 10,000 Feet above Sea Level

Lower Slopes of the Mountains: At This Point the Elevation Is 8,100 Feet above Sea Level

At This Observation Point, Elevation 9,000 Feet, the First Hint is Given of the Magnificent View That Greets the Traveler at the Summit



Toll Gate at Cascade, 7,400 Feet above Sea Level, Where the Real Climb Begins

The road is built according to the best engineering practice with the question of safety constantly in view. The grade at no point exceeds 10 ft. in 100 ft., and reaches this maximum at only three or four places. The roadway is 20 ft. wide except on curves, where it is from 35 to 40 ft. wide. It is surfaced throughout with disinte-

grated granite. There are turnouts and view stations, as well as supply stations for the motor cars, at frequent intervals along the route. In some places the road consists simply of a ledge blasted from the solid rock of a precipice, and at these and other points where there is an element of danger, a low wall has been built to prevent any car not under proper control from running over the edge. At the frequent passing places there is a wall in the middle of the road that separates the up-bound from the down-bound traffic. This is a new feature in mountain-road construction in this country, although it has been in use in the Alps for a number of years.

Construction Gang Excavating a Ledge for the Roadway at a Curve 1,100 Feet below the Summit
This Car has Climbed to an Elevation of 11,500 Feet, a Few Hundred Feet below Timber Line
Halfway Up to the Summit: One of the Peaks of the Rampart Range in the Distance

The cost of the Pike's Peak automobile road was originally estimated at about $175,000. It is the highest motor road on the western hemisphere with the exception of one in Bolivia, which crosses the Andes at a height of 17,000 ft. above sea level. The road is to be used not only by the motor busses and touring cars operated by the company that built it, but by private motor vehicles as well. The round trip can be completed in about five hours by any car possessing the power necessary for making the climb. Some idea of the popularity of the trip to the summit of this mountain is given by the fact that since 1896 a total of about 1,500,000 persons have gone to the summit over the Cog Railway, on burro back, or on foot. In addition to the regular day schedules there will be a service consisting of motor cars reaching the summit in time for sunrise, sunset, and moonlight views from the peak.

COUNTY DERIVES REVENUE FROM OIL WELLS

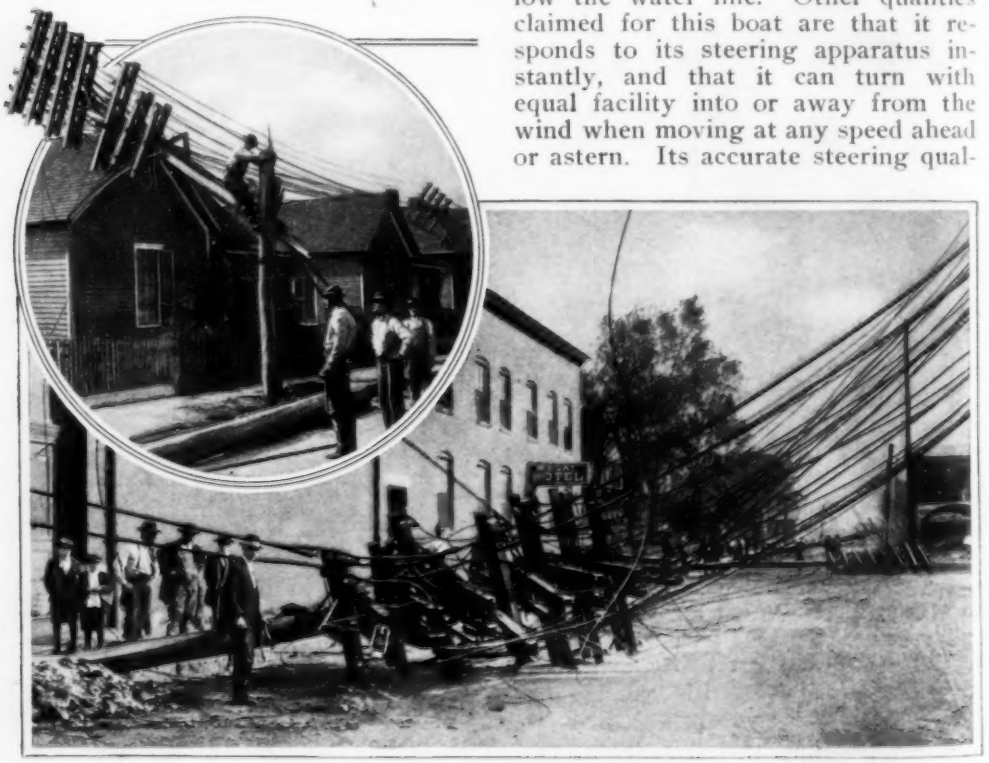
Oil was struck some time ago on a poor farm in one of the northern counties of Ohio. A number of wells that were subsequently drilled are now producing a steady flow of petroleum which gives the county a revenue of about $1,000 a month. In addition to this, about $25 a day is being derived from a small well which was struck only recently.

ELECTRIC SERVICE TIED UP BY SINGLE THUNDERBOLT

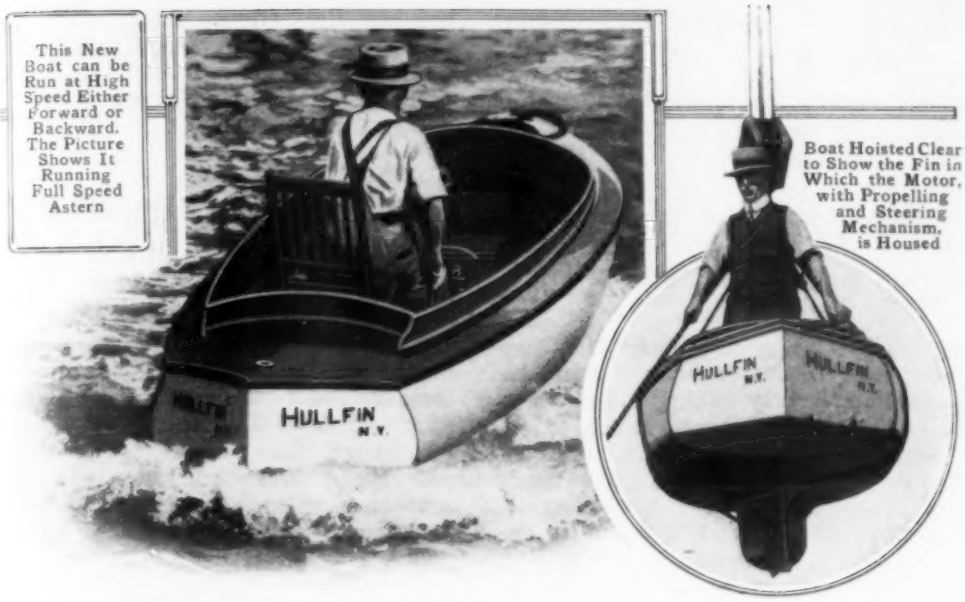
When the guy wire of a pole carrying the trunk-line feeders of the electric light and power service of Knoxville, Tenn., was struck by lightning, the falling pole carried with it 19 other poles and did a most thorough job of tying up the electric service of the city. As a result of this thunderbolt, which was the only one that did any damage in a storm of moderate intensity, the entire city with the exception of a small section served by auxiliary power was without current for two days and two nights. In residences not supplied with gas, primitive methods of lighting were resorted to and candles immediately jumped into the greatest demand. Social events had to be called off, lodge meetings were postponed, moving-picture shows were closed, and business generally was carried on under the greatest difficulties, until the linemen, working day and night, were able to restore the service.

BOAT WITH MOTOR HOUSED IN KEEL

A hollow fin that serves not only as a keel but as a housing for the motor and propelling and steering mechanism, is the interesting feature of a new type of boat which is said to have proved so efficient that it has been recommended by government authorities for use in the United States life-saving service. One of the distinctive qualities of this boat is that it can make a turn at high speed in a distance less than its own length, a quality due partly to the action of the fin as a keel, but mainly to the lowering of the center of gravity that results from placing the motor well below the water line. Other qualities claimed for this boat are that it responds to its steering apparatus instantly, and that it can turn with equal facility into or away from the wind when moving at any speed ahead or astern. Its accurate steering qual-



The Pole That Started the Trouble after being Hit by a Thunderbolt. The Upper Picture Shows How a Row of Poles were Pulled Down on the Roofs of Adjacent Houses



This New Boat can be Run at High Speed Either Forward or Backward. The Picture Shows It Running Full Speed Astern

Boat Hoisted Clear to Show the Fin in Which the Motor, with Propelling and Steering Mechanism, is Housed

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ities may be judged from a test in which a boat of this type having a length of 35 ft. and a beam of 7 ft. was run into a 60-ft. slip at a speed of 11 miles an hour, and was then turned around and run out again without shutting off the power. The fin is about half the length of the main hull, is shaped much like a fish of the mackerel type, and is just wide enough to accommodate the motor and shaft so that they will be easily accessible from the cockpit. The draft of this boat is said to be no greater than that of a boat of the ordinary type.

SERVICE METERS ARE READ WITH SPECIAL CAMERA

Photographic reading of electric, gas, and water meters has been made possible through the development of a special camera recently introduced for the use of public-utility companies. The reason for making meter readings in this manner is to obviate errors and disputes as well as to save time and labor. The apparatus is made in the form of an oblong box, provided with a high-grade lens and a simple automatic shutter which permits the time of exposure to be varied from one-fifth to one-half second, according to working conditions. Four miniature tungsten lamps, each of 3.8 volts, supplied with current from a storage battery carried inside of the camera case, provide sufficient light for photographing meter dials. Roll films permitting 75 exposures are used in the device, while a chamber for carrying two additional spools is provided. A small drawer in

Using the Camera in Taking the Reading of a Gas Meter

the front of the box also permits the storage of a half dozen extra lamps. In making readings with the instru-

ment, the front opening of the camera is pressed against a meter dial and a small lever moved. This action automatically turns on the light, opens and closes the shutter, and finally extinguishes the lamps. After each exposure the operating lever locks automatically against movement until the film has been wound preparatory for another photograph.

MACHINE GUNS FOR NEW YORK HARBOR POLICE BOATS

By HENRY JAY CASE

SOMEHOW a policeman afloat appeals to the popular humor, the public apparently having the idea that a cop is a landlubber raised to the n'th power, and that no one could possibly cut a more ridiculous figure aboard ship. Still, New York City has police sailormen, and boasts a fleet of eight launches, two dōries, and a flagship of 235 tons—an organization small, to be sure, but a skeleton one so constructed that at short notice in an emergency it can be increased to a force of several hundred fighting men, equipped with rifles, one-pounders, and machine guns. Moreover, the New York harbor cops are a hardy, fine-looking lot of watermen, inured to exposure and perfectly at home aboard ship.

There are 435 miles of waterways inside the greater city on which ride ships carrying a world's commerce—everything from giant transatlantic liners to barge-canal boats, coasters, freighters, tramp steamers, sailing ships, tankers, coast and deep-sea fishermen, excursion boats, ferryboats, and palatial yachts flying the burgees of racing clubs known across the seven seas. This means big business down the harbor and bay, up and down East and North rivers, into the Harlem and the ship canal, and out into the entrance of Long Island Sound. And where there is business there must needs be the cop to watch and patrol, to regulate traffic, chase river pirates, safeguard life and property, and recover bodies of the drowned.

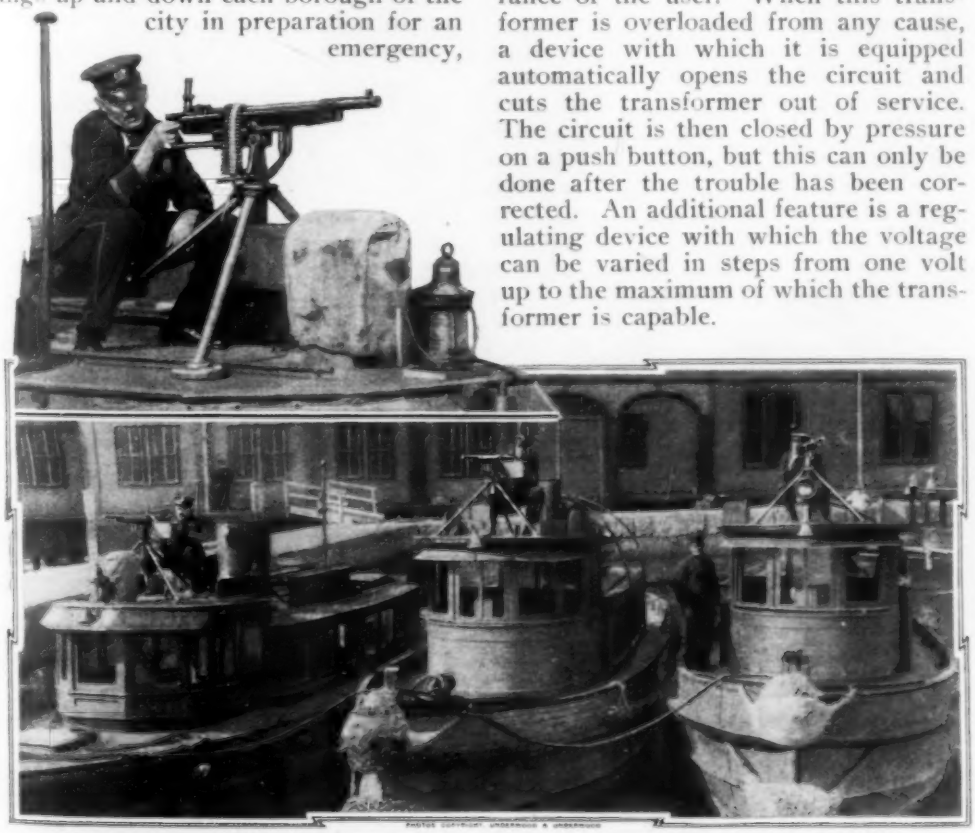
There are miles upon miles of piers and slips with rich ware and storehouses, and with the big war now on, at no previous time in the history of the harbor have there been so many treasure ships passing in and out, nor such a bulk of shipping on the piers! All this requires careful watching day and night with constant vigilance against plots and conspiracies. This, in brief, covers the job of the harbor police.

The "Patrol," flagship of the police fleet, is a twin-screw steamer, armed with two one-pound guns, fore and aft, and with a rapid-firing, or machine, gun mounted on the upper deck, capable of firing 400 shots a minute. Each of the swift launches, for night and day patrol, is armed with machine guns, and both the "Patrol" and the eight launches are equipped with powerful searchlights, which sweep every nook and corner of the wharves along the river and harbor front. The crews are drilled in gun and rifle fire, and each has a signal detail which has daily instruction and practice in the wigwag system of communication. The guns aboard ship are so mounted that they may be detached and used ashore on small carriages provided for them in case of riot or insurrection, thus making a powerful addition to the land force.

This armament, though light, is necessary. When the "Patrol" runs alongside a 40,000-ton ship to assert the authority of the municipality she must have armed power to back up her flag and station, and when a howling mob of aliens comes piling out of a pier shed to wreck a cargo, it must be met with something more forcible than a white-gloved hand or a gold badge of authority.

New York City's police department is preparing for any eventuality in the way of strike, riot, or war, and that the Federal government is in sympathy with this spirit of preparation is shown by the fact that the city police force, horse, foot, and marine, is receiving daily instruction from army and navy officers. The United States Navy, it may be assumed, is watching all entrances to the port of New York from the sea, but to the city's police is left the task of looking after the trouble on the inside stretches of New York's waterways. And to keep the harbor police in communication with the Federal and municipal authorities on land and water, and to speak to the bridge of the ships that come and go, the wig-wag system of communication has been installed. This, indeed, is also being practiced from the roofs of high buildings up and down each borough of the city in preparation for an emergency, should telephone and telegraph communication be broken or destroyed by earthquake, conflagration, riot, or war.

In case of trouble on a large scale, the New York police department should be in condition to give a good account of itself as a supplementary force to both the army and navy.



How New York has Increased the Efficiency of Her Harbor Police: These Machine Guns Are Capable of Firing 400 Shots a Minute

TRANSFORMER FOR RUNNING ELECTRICAL TOYS

The use of small transformers connected with electric-lighting circuits and designed to transform the current into one suitable for operating electrical toys is becoming increasingly common. A new transformer made for this purpose apparently eliminates all danger from short circuits, and other troubles that may arise from accident or from the carelessness or ignorance of the user. When this transformer is overloaded from any cause, a device with which it is equipped automatically opens the circuit and cuts the transformer out of service. The circuit is then closed by pressure on a push button, but this can only be done after the trouble has been corrected. An additional feature is a regulating device with which the voltage can be varied in steps from one volt up to the maximum of which the transformer is capable.

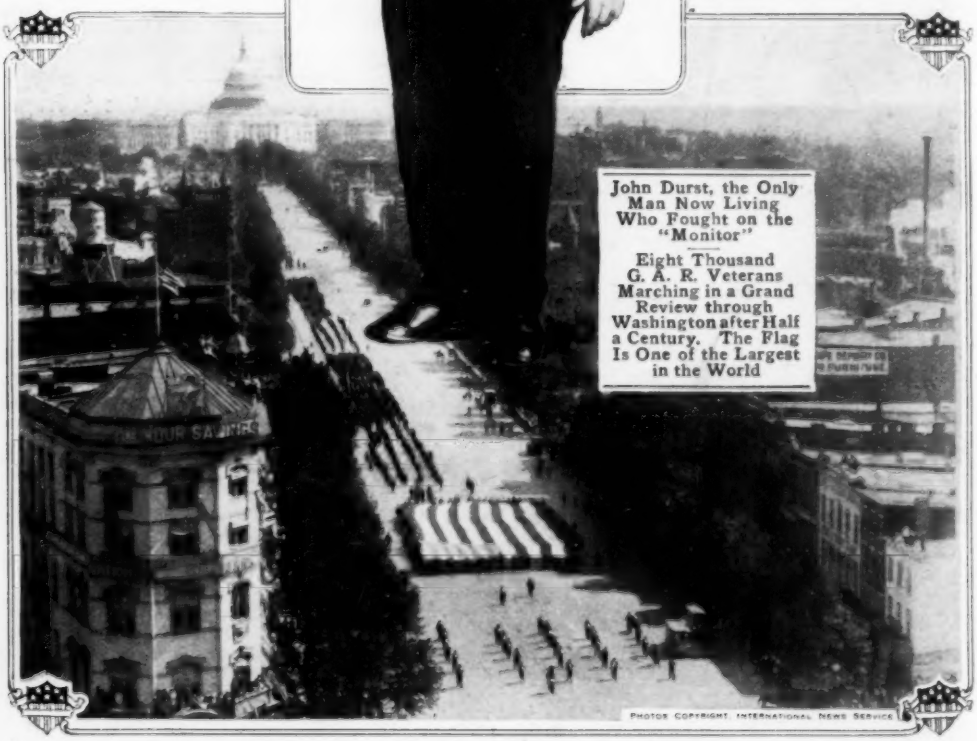
REMNANT OF UNION ARMY IN REVIEW AT CAPITAL

As the crowning feature of the forty-ninth annual encampment of the G. A. R., 8,000 veterans of the Civil War marched down Pennsylvania Avenue at Washington on September 29 and saluted President Wilson, just as they saluted President Johnson half a century ago upon their triumphant return from the battle fields.

The review was one of the most impressive that the capital has ever witnessed. In the place of the broad, even lines of youthful fighters who once filled the same thoroughfare, there were time-thinned regiments of old men. Some of them had to be supported by attendants, several were blind, and many marched with the aid of canes.

As they passed the stand, which was at the point where Johnson reviewed them years ago, they cheered President Wilson, a southerner. The hatred once fostered after the bitterness of a harrowing campaign was gone. The president stood with bowed head for four hours while the faltering line of men passed.

There was not a single man in the parade who commanded an army during the war. In the ranks, however, marched John Durst, the only man now living who fought on the "Monitor" during its memorable encounter with the "Merrimac."



John Durst, the Only Man Now Living Who Fought on the "Monitor"

Eight Thousand G. A. R. Veterans Marching in a Grand Review through Washington after Half a Century. The Flag Is One of the Largest in the World

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THE CRUMBLED MASONRY THAT WAS PRZEMYSL

Przemysl was Shelled by Russians, Blown Up by Austrians, and Again Battered by Germans

German Sentry at Fort No. 9, Przemysl, after Its Capture

Guns and Cupolas of Fort No. 11 which Show Przemysl's Condition

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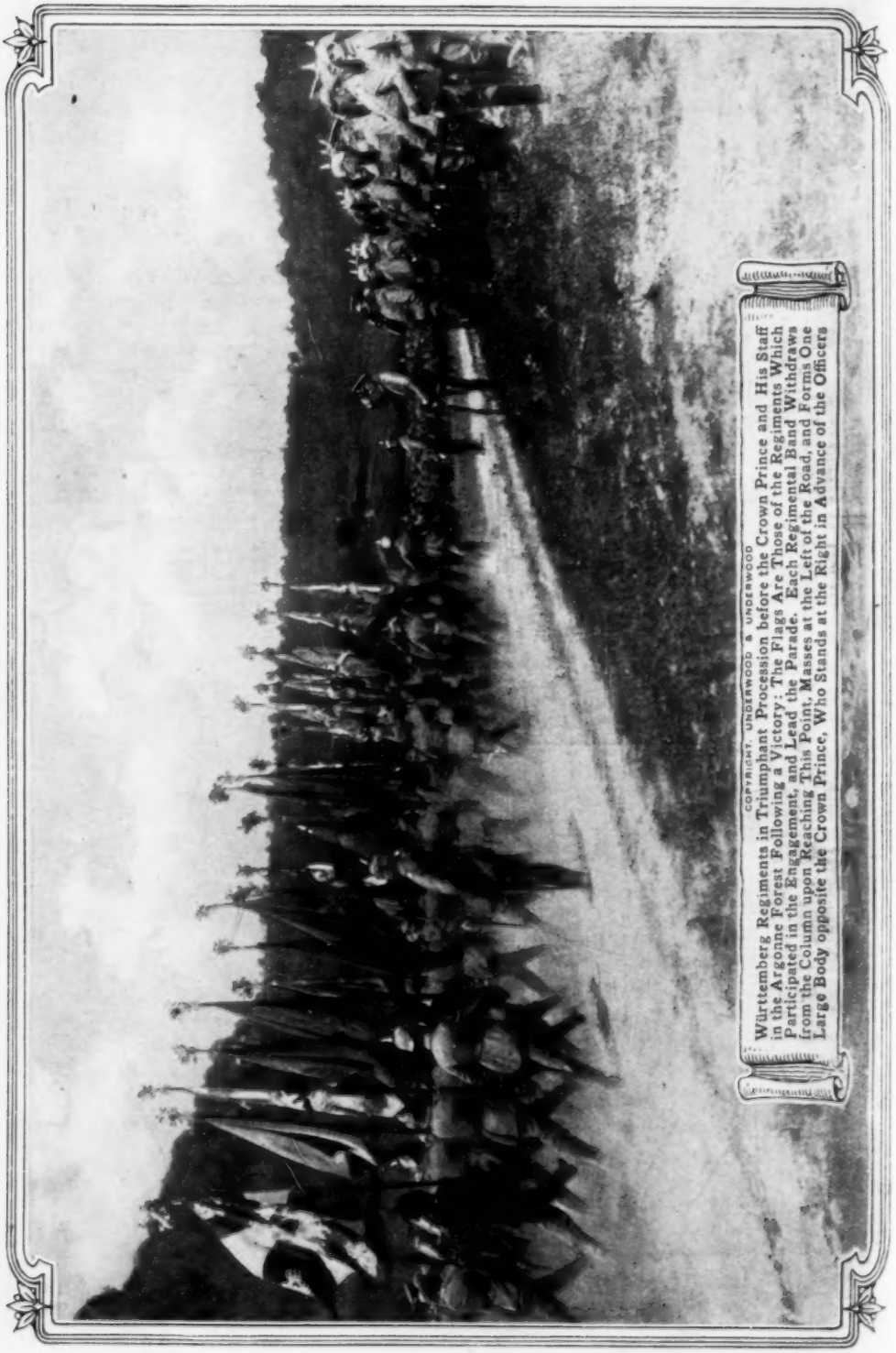
CROWN PRINCE REVIEWS VICTORIOUS TROOPS



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Württemberg Regiments in Triumphant Procession before the Crown Prince and His Staff in the Argonne Forest Following a Victory: The Flags Are Those of the Regiments Which Participated in the Engagement, and Lead the Parade. Each Regimental Band Withdraws from the Column upon Reaching This Point, Masses at the Left of the Road, and Forms One Large Body opposite the Crown Prince, Who Stands at the Right in Advance of the Officers

STRIKING SCENES ON EASTERN BATTLE FRONT

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Russian Cavalry Division Making Orderly Retreat before the Advancing Germans

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A Ruin in the Eastern War Zone Which Illustrates the Efficiency of German Guns

Throughout Galicia and Poland Many Century-Old Bridges have been Destroyed by the Czar's Retreating Forces

STRAW-COVERED FLOOR OF CRUDE HOSPITAL

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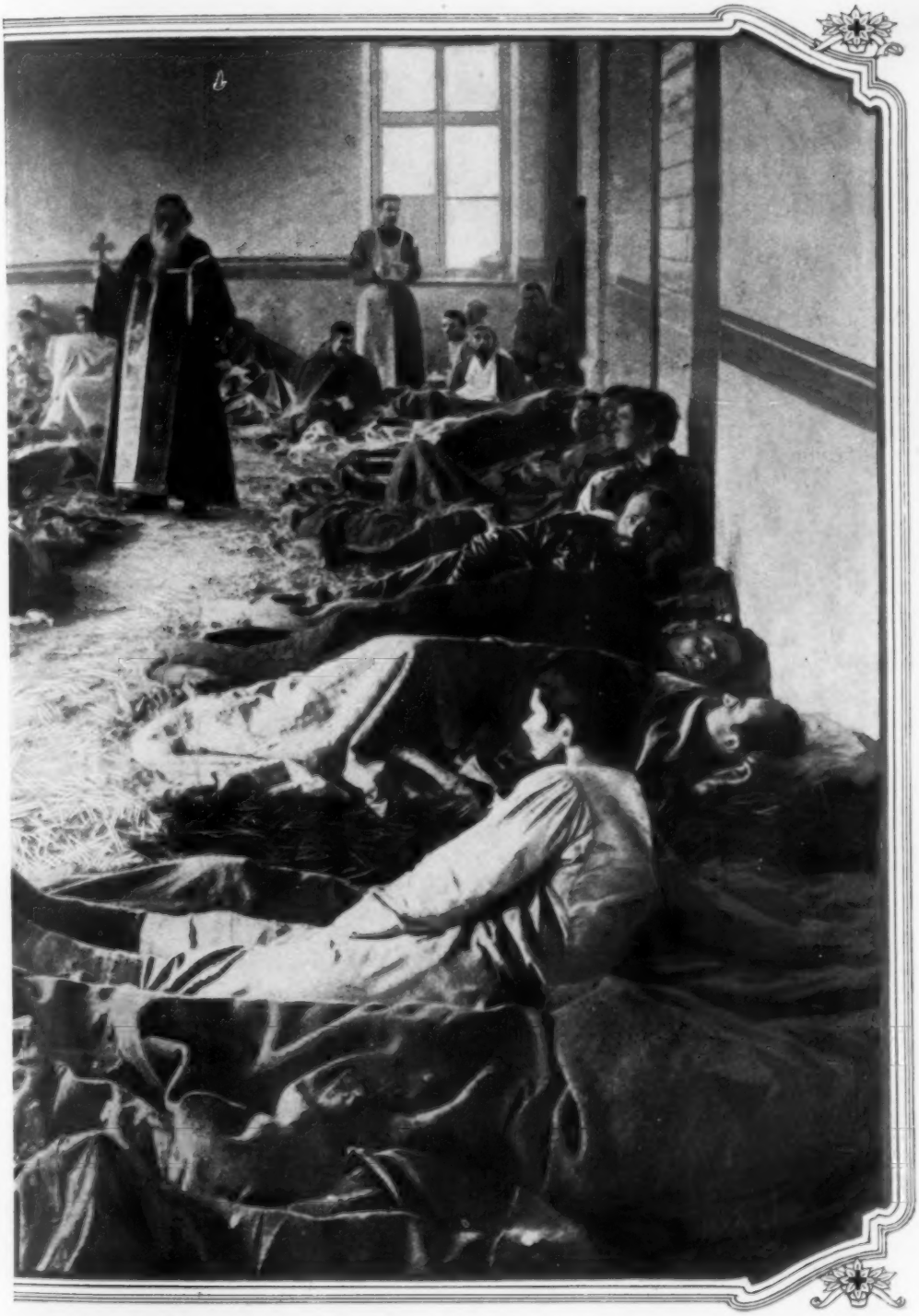
THE grim, human side of war as the men in the fields and trenches find it, is pictured realistically here, where military hospital, where the suffering and privations of the sick, crippled soldiers, and the totally other parts of the war zone. The priest in the background attempts to cheer the men, and is frequently called

FOR SCORES OF WOUNDED RUSSIAN SOLDIERS



the glamor and glory of battle are far removed. The photograph shows the interior of an improvised Russian inadequate provision for their care are strikingly manifest. There are many of these places in Russia, as in upon to perform the last rites over their bodies.

IN THE WAKE OF THE RETREATING RUSSIANS

One of the Ironies of War: Russian Prisoners Pulling Their Machine Guns behind Them at the Command of Their Captors

Russian Cannon Struck Squarely in the Muzzle by a German Shell during Lemberg Battle

Guns Captured from Russians being Loaded into Trains

Germans Searching Abandoned Trenches for Waste Metal

MAKING OBSERVATIONS FROM CAPTIVE BALLOON

Directing Artillery Fire from Captive Balloon of German Signal Corps: The Observer Is About 300 Feet from the Ground

Removing the Heavy Felt Boots Worn by Observer, Who has Just been Relieved

Launching a Captive Balloon: The Observer Has a Telephone Strapped to His Body, Enabling Him to Communicate with His Superiors

The Pulley at the Left Moves along an Anchoring Cable and by Drawing upon Ropes the Balloon is Pulled to Earth

BEHIND FIRING LINES IN MODERN ARMY CAMPS

Comfortably Arranged Summer Quarters of German Detachment
Soldier Trying How Long He can Remain in This Position
Bomb-Proof Subterranean Cabins for German Officers
Sleeping Chamber in Barracks of German Officers' Camp on Eastern Front

TREATING WOUNDED AND CRIPPLED SOLDIERS

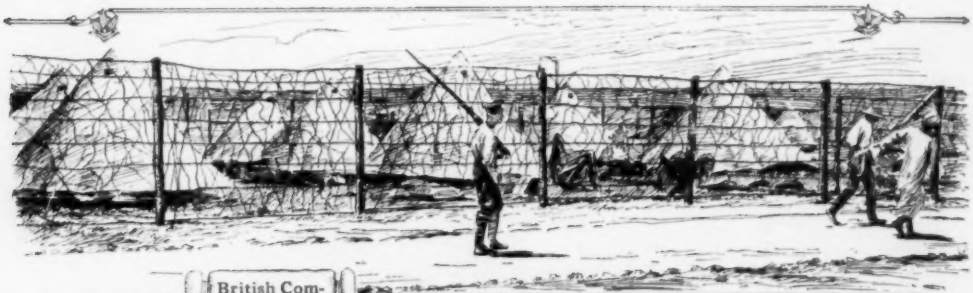
German Soldiers Accustoming Themselves to the Use of Their Artificial Hands

One of the Means of Teaching the Maimed to Overcome Awkwardness

Using an Electro-magnet to Remove Splinters from a Soldier's Eyes

Orthopedic Apparatus being Employed to Assist in Regaining Use of Hands and Feet

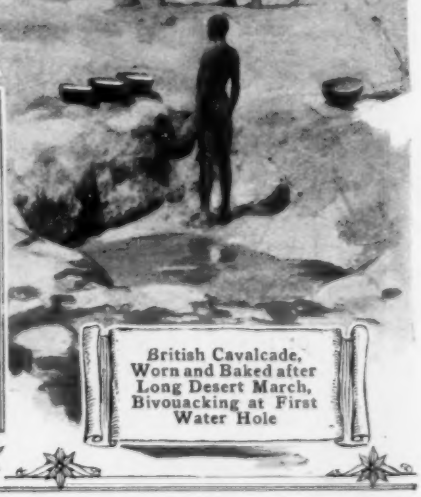
ON DESERT SANDS WITH EXPEDITIONARY FORCES



British Compound at Alexandria for the Disciplining of Soldiers

Turkish Military Caravan Procuring Water at Oasis Well

Palm Leaves Stuck in the Hot Sand Shade This Crude Field Kitchen in a Singhalese Camp in Egypt



British Cavalcade, Worn and Baked after Long Desert March, Bivouacking at First Water Hole

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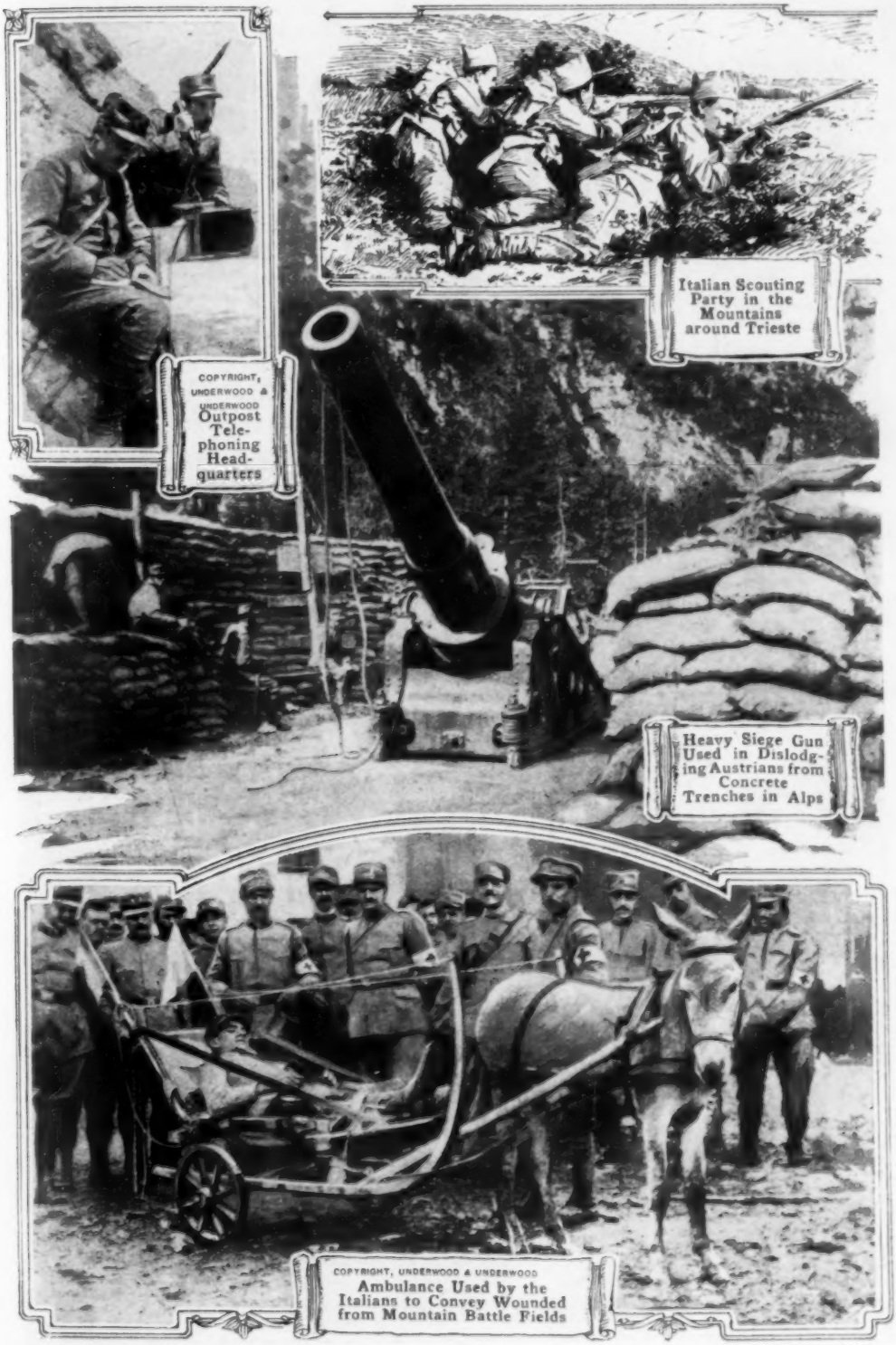
WITH THE ITALIANS ON ALPINE BATTLE FRONT



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Outpost Telephoning Headquarters

Italian Scouting Party in the Mountains around Trieste

Heavy Siege Gun Used in Dislodging Austrians from Concrete Trenches in Alps

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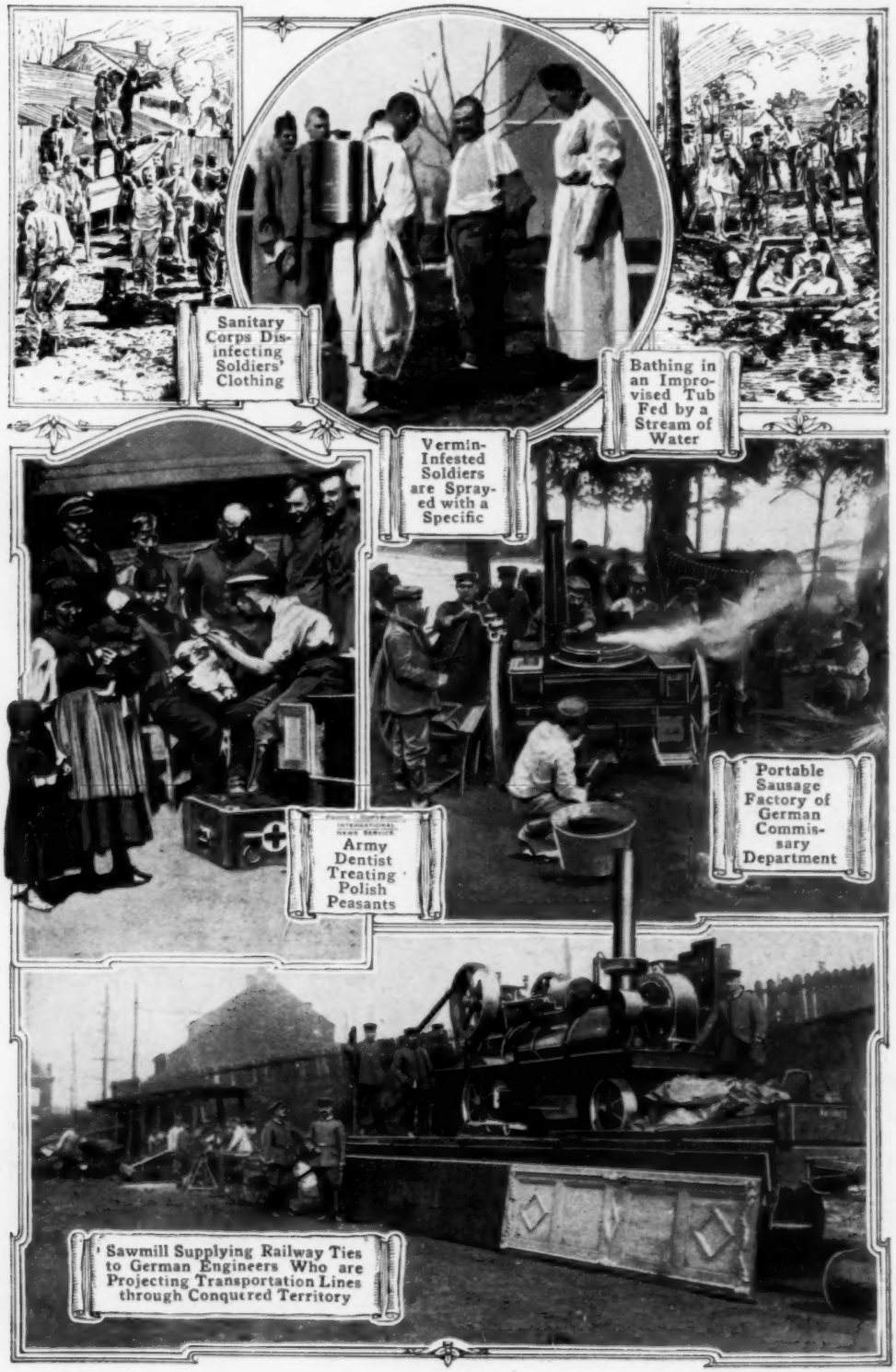
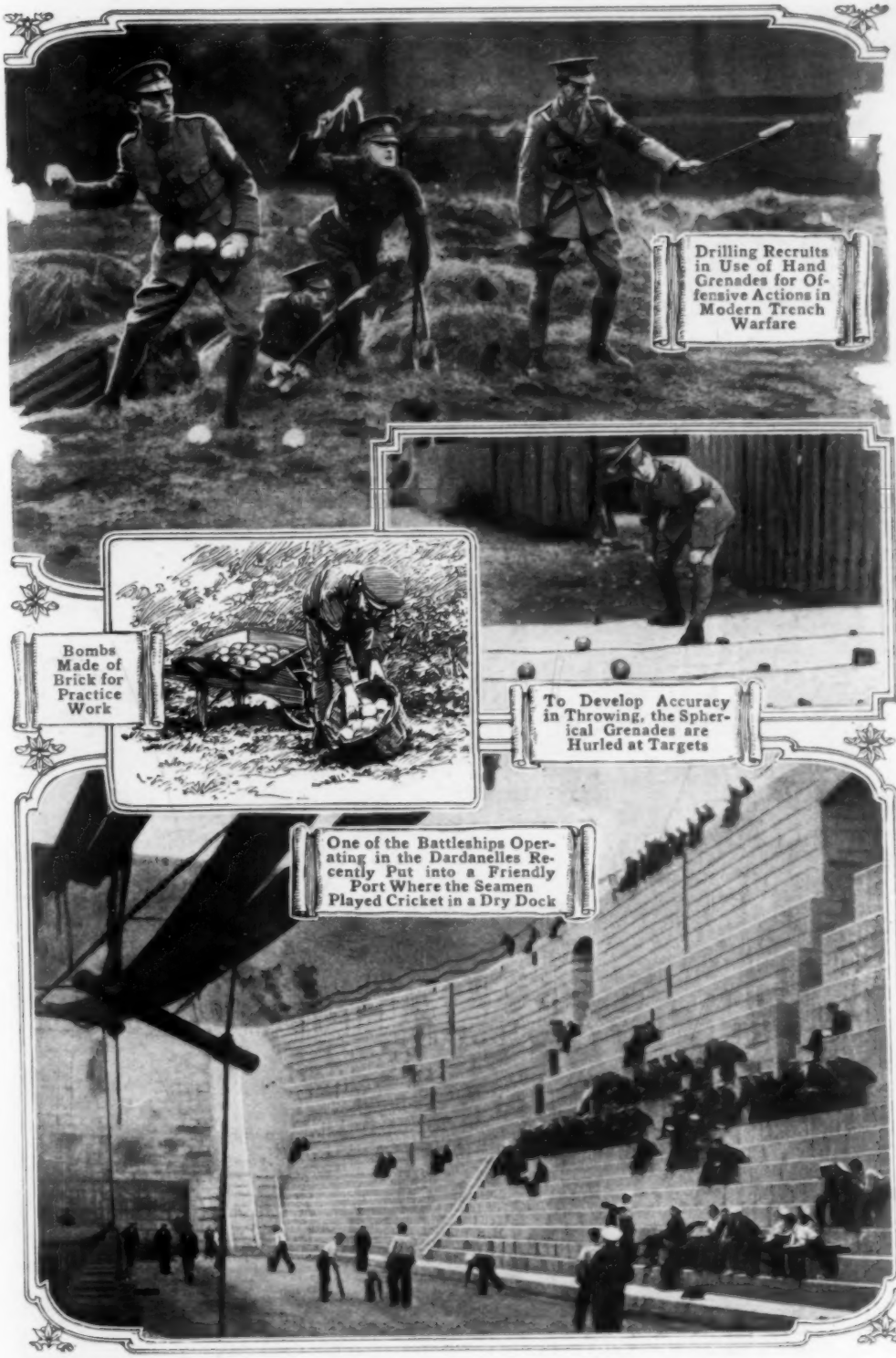
Ambulance Used by the Italians to Convey Wounded from Mountain Battle Fields

SIDE LIGHTS ON WAR FROM GERMAN VIEWPOINT


Sanitary Corps Disinfecting Soldiers' Clothing
Vermin-Infested Soldiers are Sprayed with a Specific
Bathing in an Improvised Tub Fed by a Stream of Water
Army Dentist Treating Polish Peasants
Portable Sausage Factory of German Commissary Department
Sawmill Supplying Railway Ties to German Engineers Who are Projecting Transportation Lines through Conquered Territory

BRITAIN'S DEFENDERS AT PRACTICE AND PLAY



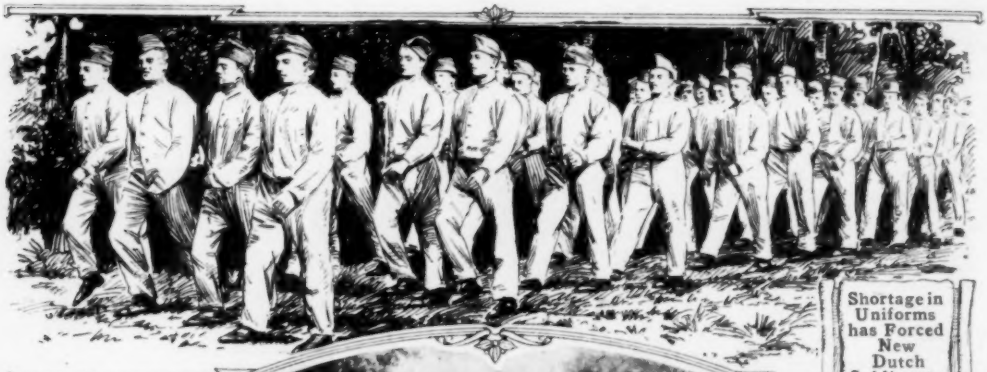
Drilling Recruits in Use of Hand Grenades for Offensive Actions in Modern Trench Warfare

Bombs Made of Brick for Practice Work

To Develop Accuracy in Throwing, the Spherical Grenades are Hurled at Targets

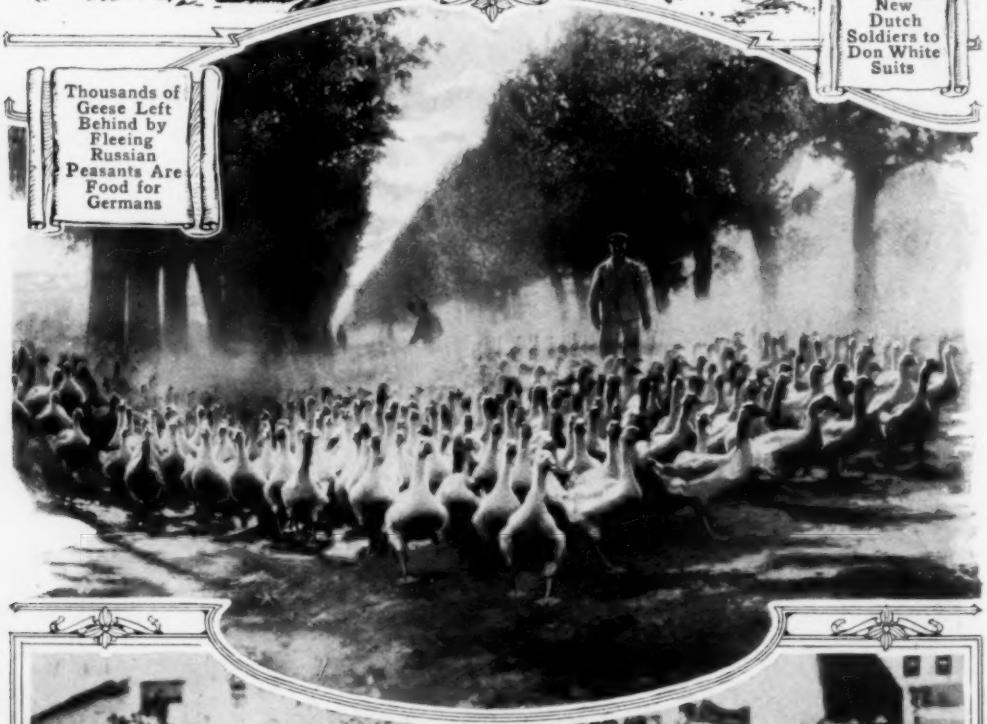
One of the Battleships Operating in the Dardanelles Recently Put into a Friendly Port Where the Seamen Played Cricket in a Dry Dock

RANDOM GLIMPSES OF BATTLE-RIDDEN EUROPE



Shortage in Uniforms has Forced New Dutch Soldiers to Don White Suits

Thousands of Geese Left Behind by Fleeing Russian Peasants Are Food for Germans



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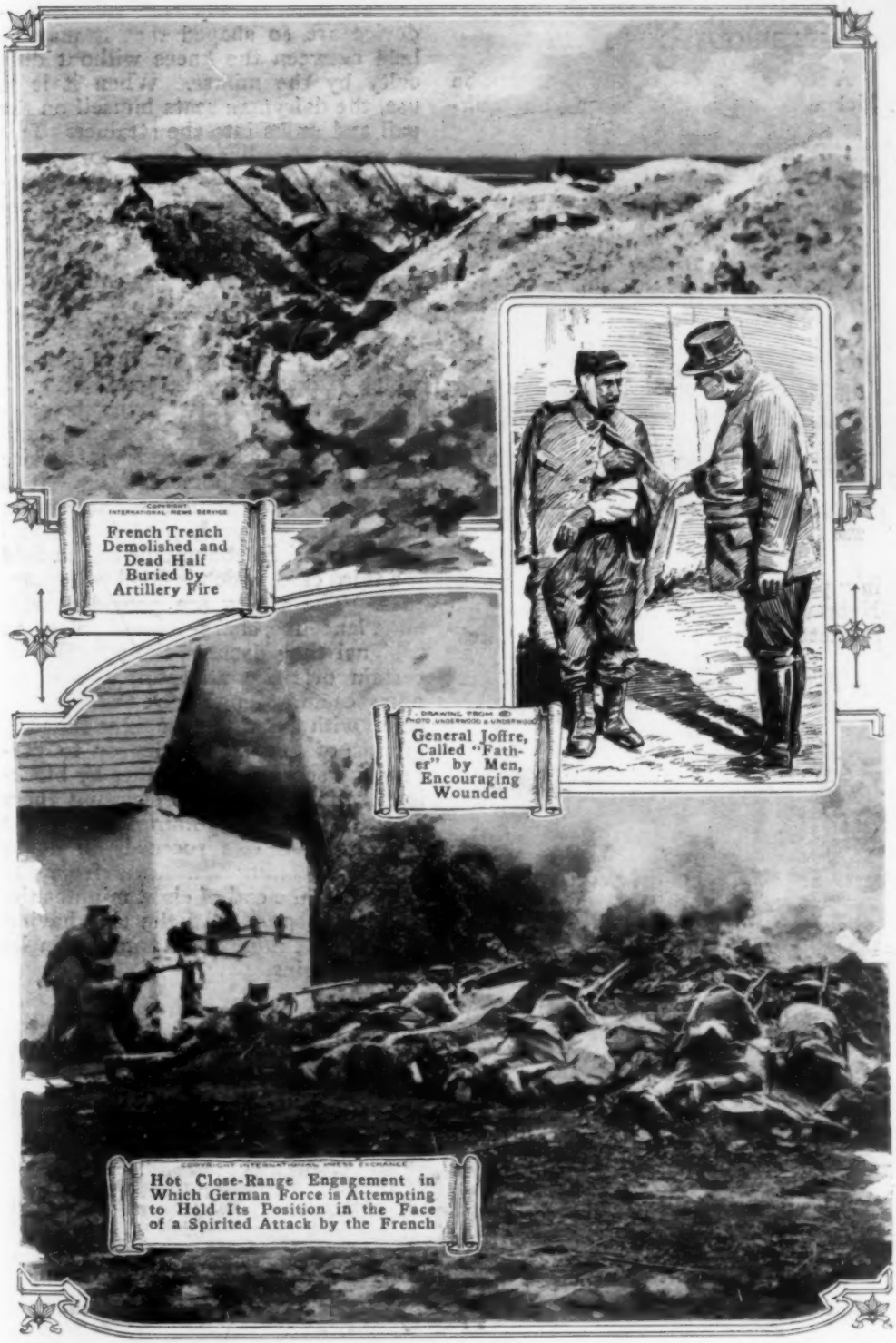
Pathetic Scene in Galician Village Showing Exodus of Jews upon Approach of Germans

GRIM PHASES OF WAR SEEN ON BATTLE FIELDS



French Trench Demolished and Dead Half Buried by Artillery Fire

General Joffre, Called "Father" by Men, Encouraging Wounded

Hot Close-Range Engagement in Which German Force is Attempting to Hold Its Position in the Face of a Spirited Attack by the French

H. M. T. A. G. R. T. K. A.!
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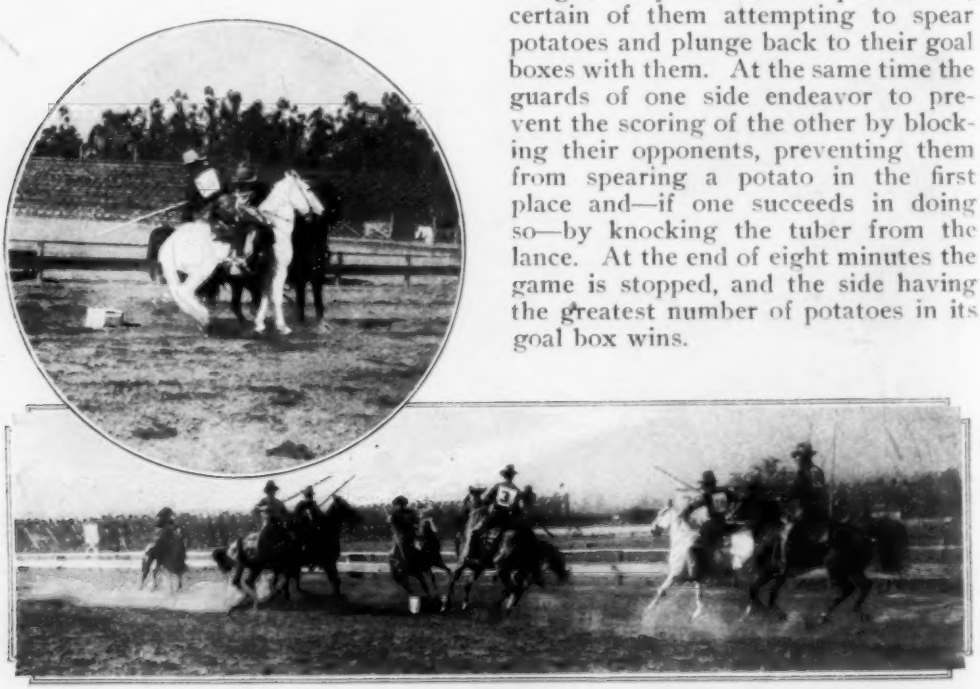
SANITARY MILK PAIL MADE AFTER CURIOUS PATTERN

A sanitary milk pail which cannot be kicked over by a cow during the milking process has been invented by a Nebraskan. Fastened in the lid of the bucket is a flexible tube that terminates in a straining funnel. The sides of this device are so shaped that it may be held between the knees without difficulty by the milker. When it is in use, the dairyman seats himself on the pail and milks into the strainer. This promotes cleanliness, tends to prevent the milk being spilled, and makes it unnecessary for a man to carry a stool with him while doing his work.

The Milking is Done Directly into the Strainer, While the Milker Sits upon the Bucket

POTATO RACE IS FAST GAME WHEN PLAYED BY COWBOYS

Although lacking in that science which makes polo the game it is, a sport indulged in this year by the cowboys of the Southwest at their annual meet is one which demands an exercise of much skill in horsemanship. It is played by eight mounted men; four on each side. At each goal is a small square box. In the middle of the field is a third case, which is filled with potatoes. The riders are provided with long, lancelike, sharp-pointed poles. At a signal they dash at the potato box, certain of them attempting to spear potatoes and plunge back to their goal boxes with them. At the same time the guards of one side endeavor to prevent the scoring of the other by blocking their opponents, preventing them from spearing a potato in the first place and—if one succeeds in doing so—by knocking the tuber from the lance. At the end of eight minutes the game is stopped, and the side having the greatest number of potatoes in its goal box wins.



Lower View: The Start of the Game: The Riders are Dashing Toward the Potato Box. Top View: The Rider on the White Horse has Scored a Point by Dropping a Potato in His Goal Box

NEW NAVAL GUNS HAVE HIGH ANGLE OF FIRE

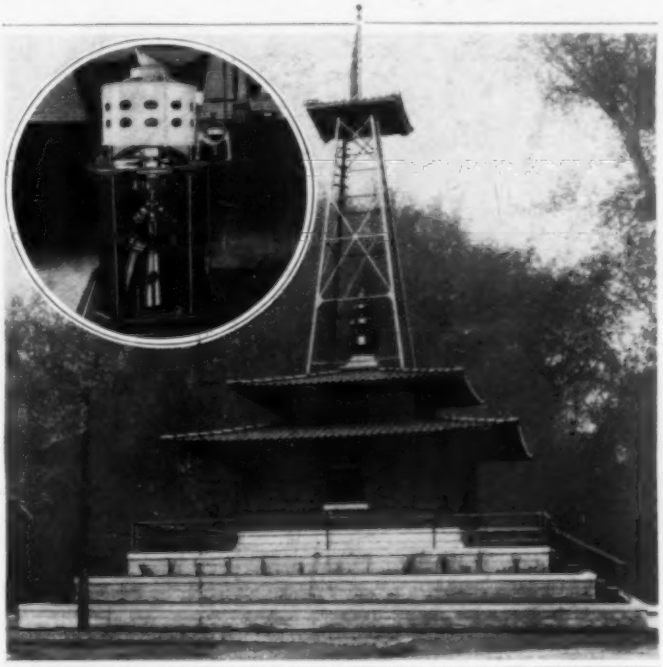
An elevation of 30°, an angle that is just double that of the older ships, is to be given the guns of the new United States battleships. Apparently the upper part of the arc is intended mainly to facilitate the handling of the gun in rough weather, as, even with the present angle of fire, the guns of battleships of the type of the "Arkansas" have a range of 11 sea miles, or about 22,000 yd. Official reports show that the British battle cruisers engaged in the fights of the North Sea and off the Falkland Islands inflicted severe damage on the German ships at ranges of about 18,000 yd. Owing to the curvature of the path traveled by projectiles fired at such a range, a plunging fire results, the projectile usually striking the deck or the upper part of the ship instead of the side. In view of this, plans are being considered for protecting the decks of the new battleships with armor considerably thicker than that heretofore used for this purpose. This additional armor will add considerably to the weight of the ships.

ELECTRIC PLANTS IN THE UNITED STATES

Of the 4,992 electric plants in the United States 3,199, approximately 64 per cent, are able to supply light, heat, and power during the day as well as during the night, the remainder supplying current only during the night. Central-station service is provided for a total of 6,775 cities, of which 4,336 have full day and night service.

ODD PUMPING PLANT BUILT IN MUNICIPAL PARK

At Waterloo, Ia., a pumping station over an artesian well which supplies the town with water, is situated in one of the local parks on ground which is inundated when an adjacent creek overflows. In designing the structure it was necessary, because of this, that its floor level be placed above the high-water mark and that this height be attained in such a manner as not to make the building unsightly in appearance. An 8-ft. foundation was constructed and three pyramid terraces, bound by concrete retaining walls, built about it. That the structure itself might be in harmony with its stepped elevation, the plant was built after the lines of a pagoda.

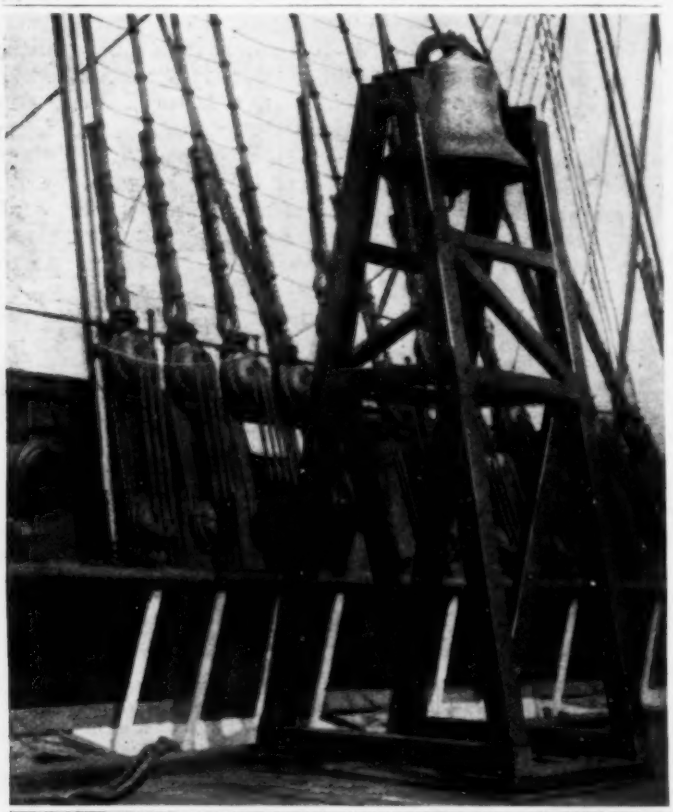


The Terraces Raise the Building above the High-Water Mark. Insert Shows the Type of Pump Employed in This Novel Station

¶The only state in which tolls are charged for using the Lincoln Highway is Pennsylvania, and a strong movement is now on foot for abolishing these charges.

FIRE ALARM BELL ERECTED TO PROTECT "IRONSIDES"

As a means of helping to safeguard the "Constitution"—"Old Ironsides"—



Alarm Bell Which would Summon Assistance Should Fire Break Out Aboard the "Constitution"

which distinguished itself during the early part of the nineteenth century and especially in the War of 1812, from being destroyed by fire, a large alarm bell has been mounted at the pier where the aged naval relic is moored in the Charleston Navy Yard. This is supported by a heavy wooden framework which stands close to one side of the ship. A cord extends from the bell over the ship's railing in ready reach of the watchman. Hundreds of visitors inspect the vessel daily and for a long time it has been recognized that precautions must be taken to protect it against fire.

HYDROELECTRIC PLANTS IN THE PYRENEES

To provide hydroelectric power for Barcelona, Spain, the fourth largest concrete dam in the world is now in process of construction at Talarn, on the edge of the Pyrenees. This dam, which is now nearing completion, will stand 269 ft. above the bedrock of the river and over 328 ft. above the lowest point of its foundation. It will raise the level of the water 243 ft. and will form a reservoir containing nearly 230,000,000 cu. yd. of water. This plant will produce 50,000 hp. The water, after having done its work in the turbines, will be returned to the river and farther downstream will be captured anew and forced to turn the wheels of the Barcelona plant, where 56,000 hp. will be generated. The electrical energy produced at Talarn will be transmitted at 110,000 volts for a distance of 130 miles to Barcelona and the surrounding district and then transformed to suitable voltages for distribution. This plant is only one of a number of important water-power projects now being developed in the Pyrenees. In these projects, irrigation as well as the production of power forms an important part.

¶The value of scrap metal, exclusive of platinum, gold, silver, steel, and iron, salvaged during 1914 amounted to $57,039,706. About 127,882 tons of copper, 61,062 tons of lead, 71,642 tons of zinc, and 4,522 tons of aluminum were recovered.

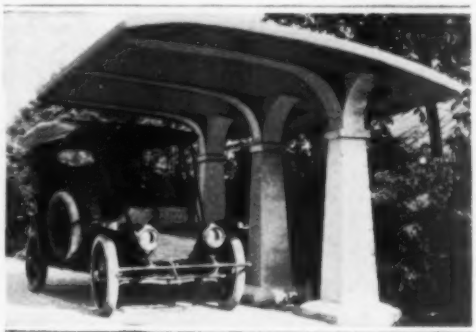
Interior of a Western Railway's Agricultural Demonstration Car

FARM DEMONSTRATION CAR USED BY RAILWAY

Some of the agricultural demonstration trains which are sent through various western states by different railway companies are carrying elaborate exhibits intended for the education and help of the farmer. A number of roads have expended thousands of dollars in attempting to teach settlers along their routes how to raise better and bigger crops, how to handle live stock and poultry, and moreover, how to become successful agriculturists. The accompanying illustration shows the interior of a car which carries an exhibit devoted to live stock. It includes papier-mâché models of cows and horses, plaster molds showing the physiology of these and other farm animals, and various things of value in giving a farmer an insight into approved ways of caring for his live stock. A car of this kind is attended by a competent authority on animal husbandry who unravels many of the perplexing problems which confront farmers, especially those who are comparatively inexperienced in the industry.

ODD CONCRETE PROTECTION SHIELDS MOTOR FROM SUN

In one of the Chicago cemeteries a reinforced-concrete structure of interesting design has been erected as a motor-car shelter. It is a canopy that extends out over a driveway and is supported by three heavy pillars, set in a row along one side. There is no counterweight to balance the slightly tilted roof, as the foundation serves as the anchor for the overhanging leaf. This naturally gives it a top-heavy appearance, although it is adequately supported.



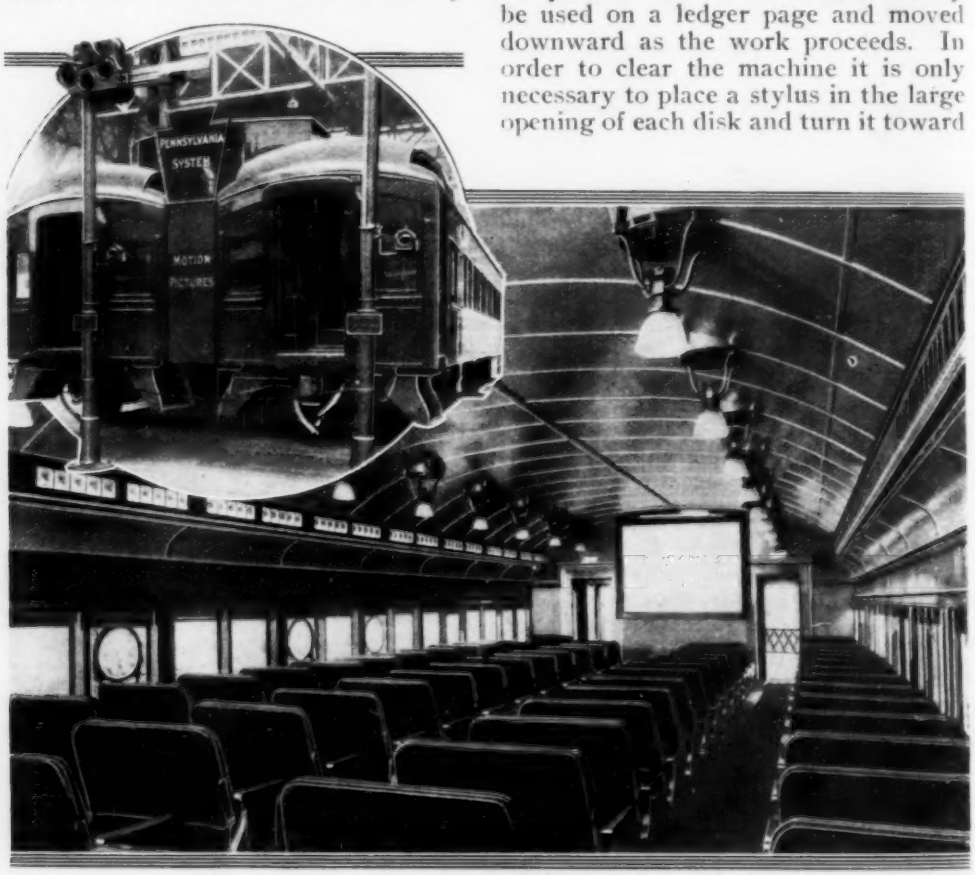
The Canopy Is of Rigid Construction and Requires No Counterweight to Balance the Roof

RAILWAY CARS JOINED TO FORM MOVIE THEATER

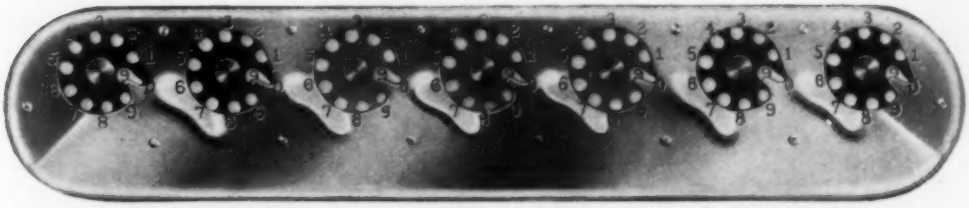
As a part of its display at the Panama-Pacific Exposition an eastern railway company maintains a motion-picture theater, consisting of two all-steel coaches joined side by side, in which films showing scenery at various points of interest along its lines are exhibited. The character of this little parlor is interesting. In building it the adjacent sides of the cars, set parallel with each other, were removed and the space bridged and roofed, forming one spacious, fireproof room. The interior is fitted with four rows of plush seats. The windows bear the pictures of typical scenery to be found along this company's route, as well as the seals of the various states traversed by the road. The cars are set on standard track and will ultimately be returned to service.

CALCULATING INSTRUMENT FOR ACCOUNTANTS

Designed to meet the requirements of bookkeepers and clerical workers, a comparatively inexpensive rapid-calculating device has been introduced which is capable of adding, subtracting, and multiplying quickly and accurately. The instrument is about 10½ in. long, 2¼ in. wide, and ½ in. thick. It is provided with a series of seven dials which are revolved by a stylus when making calculations. A single turn of one of the wheels adds a figure to a previous register and simultaneously shows a total. The device may be used on a ledger page and moved downward as the work proceeds. In order to clear the machine it is only necessary to place a stylus in the large opening of each disk and turn it toward



Above: Exterior of Railway Motion-Picture Theater. Lower View Shows the Interior and Finishing of the Unusually Built Auditorium



The Instrument Adds, Subtracts, and Multiplies with Accuracy and Quickness

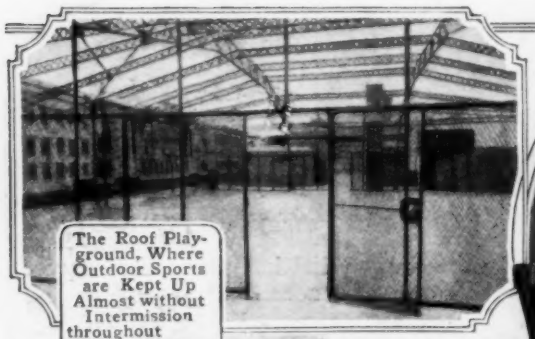
the left until zero is reached. To correct an error the operator merely turns the proper dial backward the required number of spaces.

DUTIES OF WOMANHOOD TAUGHT IN HIGH SCHOOL

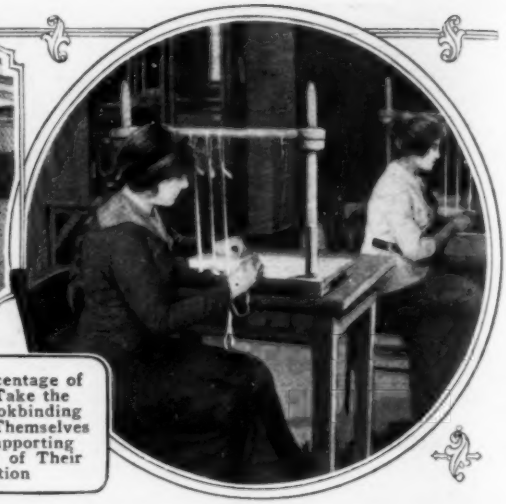
ABOUT ten years ago, when a high school for girls was opened in a ramshackle building located on the border of the East Side, in New York City, the first step was taken in the development of educational ideals and methods which at that time were nothing less than revolutionary. In the meantime this institution, because it meets a real educational need, has grown wonderfully. It is now known as the Washington Irving High School. It is housed in its own school building, which is one of the largest and best equipped in the world. It is a true high school, with the usual curricula, but it has one feature that distinguishes it from most institutions of its kind. Its special work is that of training girls to take their proper place in life as women, and all other features, academic and otherwise, are subordinated to this.

Although the school now has more than 6,000 pupils, the organization is such that the individual needs of every girl, as well as her prospective position in life, are given constant consideration from the time she enters the school until she graduates. Thousands of the pupils live within walking distance of the school and most of them come from the homes of wage earners. The majority of these girls will eventually marry and have homes of their own, and in most cases this home will be a city flat. For this reason home management, particularly the management of a little home, forms one of the most important features of the training. This training is given in a practical and effective way. A city flat is included in the institution, and the girls are not only told how to take care of it but each is given her turn in actual management. Since many of the girls will be compelled to work for their livelihood, at least for a time, a great variety of vocational courses is provided. Training in the duties of motherhood is given by the "laboratory" method. Babies are brought to the school regularly and the pupils are given instruction and practice in dressing and undressing the babies and in caring for them generally. The babies used in this work are usually the little brothers or sisters of some of the pupils.

During the first year the pupil is given a chance to find out where her real interests lie. With the beginning of the second year the elective system comes into play, and at this time most of the pupils begin to specialize. The usual academic work is given, but in such a way as to show the relation of the studies to real life. In vocational work the pupil has the choice of courses that will fit her for business and office work, for dressmaking, bookbinding, or some other trade that a woman can follow; or she can take courses that will fit her for teaching or for an artistic career. More than five-sixths of the pupils avail themselves of the vocational training provided by the school. There is a group of about



The Roof Playground, Where Outdoor Sports are Kept Up Almost without Intermission throughout School Year



A Large Percentage of the Pupils Take the Course in Bookbinding and Thus Fit Themselves to be Self-Supporting from the Day of Their Graduation

800 each year who confine themselves to high-school work without reference to any particular calling in after life.

The work of the school does not stop with teaching the girls how to do useful things. Each is given every opportunity to acquire poise and dignity. In the Girls' Assembly the pupils are trained to speak in public and to preside at a meeting. Dancing and training in the social graces are a part of the regular instruction. The school has its theater, and in it plays written by pupils are enacted by other

Dressmaking is Taught as Thoroughly as in a Dressmaking Establishment: One of the So-Called "Fads" of the Pupils is the Making of Graduation Gowns Complete at an Expense of One Dollar, or Less

The School Laundry: Instruction in This Kind of Work is Given All the Pupils and Forms Part of the Training in the Management of a Little Home

Potting Plants in the Greenhouse of the School: Instruction in this Department Is Such That the Pupils are Competent Florists by the Time They Graduate

pupils. Healthful play forms as much a part of the day's routine as work at the school desk, and outdoor sports on the roof playground with which the school building is equipped are kept up almost without intermission throughout the school year. The school has become one of the important social centers of the city. During the school year there is a succession of social, dramatic, and musical entertainments, and exhibitions of works of art.

In the School Kitchen the Pupils are Not Only Taught How to Cook, but are Made to Realize the Importance of Such Details as Washing Dishes and Checking Weight of Purchases

Training in the Duties of Motherhood is Given by the "Laboratory" Method, Real Babies being Regularly Brought in for This Purpose

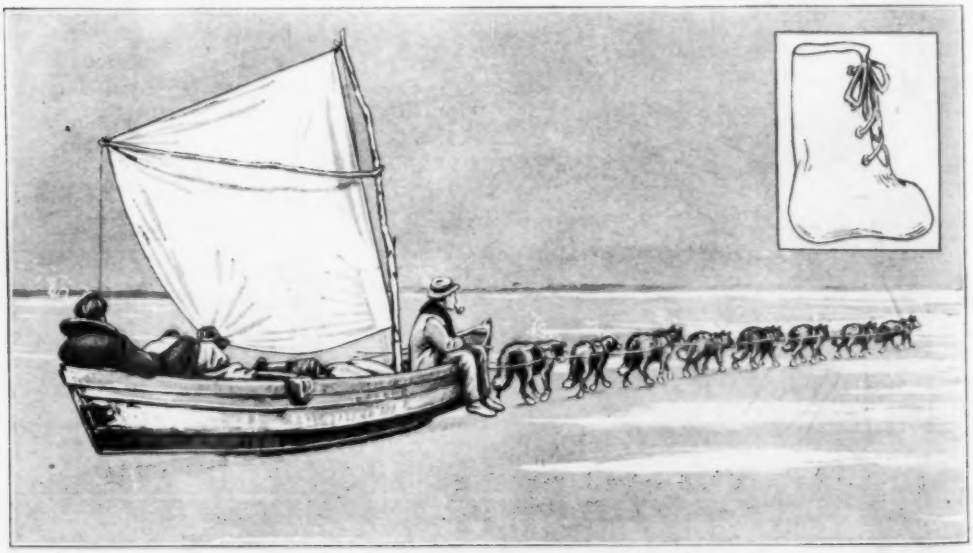
SIDE-BY-SIDE BICYCLES DRIVEN BY MOTOR

By coupling two bicycles side by side and attaching a small power wheel at the rear, a cyclist at Miami, Fla., has devised a novel motor-driven vehicle. Steel rods extend from steering head to steering head of the wheels and from one seat post to the other, and with auxiliary bracing members hold the machines together. By means of the handlebar connection the bicycles are easily steered in unison. On good roads the light contrivance drives smoothly and is able to maintain a fair speed.

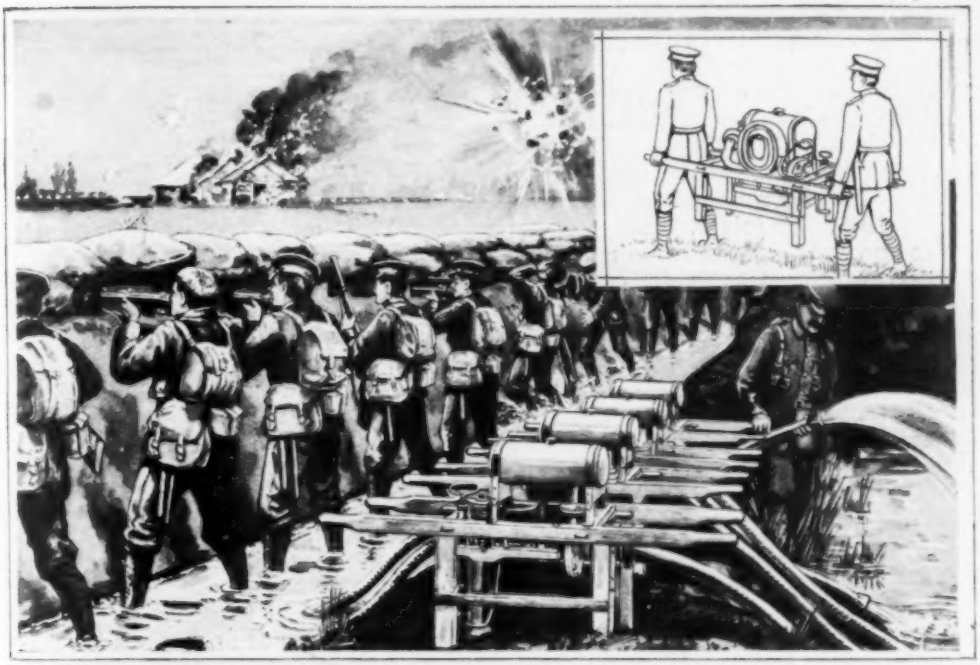
Curious Vehicle Used for Pleasure Riding by a Florida Cyclist

BOAT DRAWN OVER LAKE BY MOCCASINED DOG TEAM

After the first heavy freeze at the beginning of winter a party of prospectors working in northern Canada found themselves on the wrong side of a lake over a hundred miles wide, on the opposite side of which was the winter headquarters. They were without any means of transportation other than a boat in which were stored all their belongings and provisions. Hiring a half-breed with his dog team, they put runners under the boat and made their way easily and safely across the smooth expanse of ice, the efforts of the dog team being aided by a sail erected on the boat. To protect the feet of the animals from the hard surface of the ice each dog was fitted out with miniature moccasins made of padded buckskin.



How a Party of Prospectors Working in Northern Canada Reached Winter Headquarters After being Caught on the Wrong Side of a Lake by a Heavy Freeze



A Battery of Four Gasoline Pumps in Action Draining a British Trench in Belgium. The Picture at Top Shows How the Pumps are Transported from Trench to Trench

PORTABLE PUMP SET FOR DRAINING TRENCHES

A portable gasoline-driven pump set that is capable of discharging 30 gal. of water a minute against a head of 16 ft. is being used by the British for draining their trenches in Belgium. The entire set weighs only 120 lb., is mounted on a wooden frame that is provided with handles, and is easily carried about by two men. The pump is driven by a 1-hp. single-cylinder engine. Through the action of a knife working within the pump all fibrous material such as cotton waste and rags, as well as sand and mud, is cut to pieces, a feature that makes the pump particularly suited to trench work. The set, when fully charged with fuel and oil, will run continuously for from 10 to 12 hours. The pump is equipped with a suction hose, 8 ft. long, and a discharge hose, 50 ft. long, so that the water can be discharged at such a distance that there is little danger of its running back into the trench. When the set is to be started, the suction hose is placed in the water and the air is first exhausted by a small hand pump mounted on the frame, the discharge hose being closed by means of a throttling clip during this process.

FLEXIBLE TUBING USED FOR SUBMARINE WATER MAIN

By using flexible bronze tubing 4 in. in diameter, the problem of supplying water to Partridge Island, which lies 3,250 ft. off the mainland at St. John,

Flexible Bronze Tubing Used for a Water Main under the Harbor at St. John, New Brunswick: The Picture Shows How the Tubing can be Bent without Danger of Injury

N. B., has apparently been solved satisfactorily and permanently. The tidal range at this point is about 28 feet, there is usually a current of from two to three miles an hour, and the channel is therefore a difficult place in which to lay pipe without damaging it. A 6-in. galvanized wrought-iron pipe with ball-and-socket joints, laid several years ago, soon developed leaks, and an exposed portion was finally caught by an anchor and seriously damaged. Recourse was then had to flexible tubing, which could be reeled from a barge without danger of injury. This tubing consists of a strip of bronze wound helically, each winding overlapping and interlocking with the one preceding it, and the joint thus formed being packed with asbestos. The tubing was supplied in lengths of from 30 to 40 feet, with couplings attached. It was laid from a steam scow on which a wooden reel, 12 ft. in diameter, had been erected, the tubing being connected in lengths of about 200 feet and wound around this reel. As each section was prepared for laying, it was securely jointed to the one preceding it. The entire line was laid in a trench which was dredged as the pipe laying proceeded. In most cases the trench filled in quickly from the action of the current, and only at a few points was it necessary to dump in material for back filling.

MAKING PICTURES OF SEEDS IS NEW ART

Seeds of various kinds were used instead of pigments in making an interesting barnyard picture which is displayed at one of the exhibits of the Panama California Exposition at San Diego. This is a portrait of a white rooster which from a short distance might easily be mistaken for an oil canvas or pastel. In truth, however, it is a most painstaking arrangement of seeds. Kaffir-corn seed, for instance, was used to produce the predominating tone of brown, while white Egyptian corn gives the picture another shade of the same color. For part of the background the seed of the Eucalyptus was used, and black onion seed for the jet field. Some of the white was made by crushing seed corn into a paste and applying it to the picture. The tones are wonderfully soft, the lines good, considering the materials used, and the effect of the whole quite striking. This method of picture making was originated in the West, where it has become quite a fad.

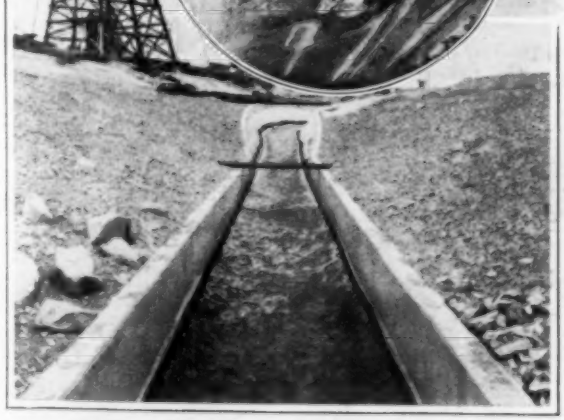
To Produce the Soft White Effect, Seed Corn was Crushed into a Paste Which was Used as a Paint

TELEPHONE CHURCH SERVICE ON ISLAND OF GUERNSEY

Residents on the island of Guernsey, in the English Channel, are enabled to listen to church service in their homes any Sunday evening at a charge of about 10 cents. Policemen and firemen, as well as lighthouse keepers and other government employes who are prevented by their occupation from going to church, are furnished the telephone service free of charge. At Platte Fougère lighthouse station sometimes as many as eight persons sit down together to hear the telephone service from a church five miles away.

DISCHARGE CHUTE FOR THE TRUCKEE CANAL

The Back-Water Wave That Forms at the Nozzle When a Small Volume of Water is being Discharged



An Intermediate Section of the Chute, Showing How the Rounded Section is Changed to a Rectangular Section. Insert Shows How the Water is Thrown Upward and Outward by the Concrete Nozzle

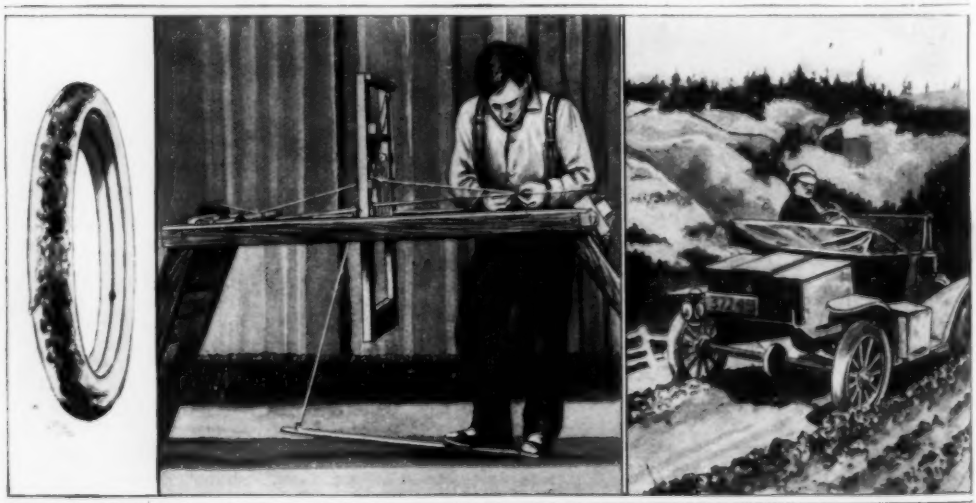
Where the Truckee main canal empties into the reservoir formed by the earth dam, 124 ft. high, that has been built across the Carson River, a novel type of chute has been installed for conducting the water past the sand and gravel slopes and discharging it into the reservoir without danger of erosion or other damage. The canal is 31 miles long and at its lower end the water surface of the full canal is 130 ft. above the bed of the river and about 20 ft. above the full reservoir level. The total length of the structure connecting the canal with the river is 1,122 ft., of which 681 ft. consists of the chute proper. The total drop in the structure is 52 ft. Leading from the canal is an approach section 300 ft. long, terminating in a rectangular fore bay, the two sides of which form weirs. Along each side of the fore bay is a concrete channel, and these two channels, or tailraces, converge into a single channel

through a funnel-shaped section located just below the fore bay. It is at this point that the chute proper begins. With this arrangement of fore bay and tailraces the water is maintained at the required level in the canal, while the volume of water that flows over the weirs into the tailraces is easily regulated by the controlling works. At this point the chute is rounded in section, but the section is gradually changed and made slightly smaller until, at the discharge end, it has a rectangular section and is 9 ft. wide and 6 ft. deep. The discharge end is a concrete structure built as a cantilever with an overhang of about 18 ft. The end of the cantilever structure is 2 ft. above the lowest point in the chute, which is 18 ft. back of the discharge end. With this arrangement the water is discharged as if from an enormous nozzle, being thrown upward and outward at a velocity of 34 ft. per second and falling at a distance of about 50 ft. from the end of the structure in a pool of water, clear of the foundations of the chute.

A curious hydraulic phenomenon was observed when the chute was put in operation. A small volume of water was first let in, and this was gradually increased until the maximum allowable flow was reached. For some time the water was pocketed in the low section just back of the nozzle, and the discharge was vertically downward instead of being in a parabolic curve. As the flow was increased a backwater wave was formed at this point, which finally rose nearly to the tops of the side walls, and it was thought necessary to increase the height of these walls by means of sand bags to prevent the water from flowing over the sides. The flow was then increased to the regular service volume, when the stream suddenly shot out from the nozzle in the calculated parabolic path and the back wave disappeared instantly. The phenomenon was repeated each time the water was turned in.

FIBER FABRIC IS EMPLOYED IN REMAKING MOTOR TIRES

By making use of a remarkably tough fabric which is woven with thread and fiber strands, a California inventor has devised a means of rebuilding dilapidated motor-car tires and making them, moreover, puncture-proof. This fabric is incorporated into the tire during the process of retreading it. The cloth, it is claimed, is a nonconductor of heat. As a demon-



At the Left is Pictured a Worn-Out Tire Which was Reconstructed and Again Put in Service, as is Indicated at the Right. The Man in the Middle is Weaving the Puncture-Proof Fabric by Hand

stration of the resisting qualities of one of these reconstructed tires, a car was recently dropped from a platform, 18 in. high, onto a plank, holding the upturned points of a number of large nails and spikes. The tire struck these, bending them over without injury to itself. This specific casing had been recovered from a roadside where it had been abandoned with a hole in it as large as a brick, and the fabric badly cut and worn around the entire circumference.

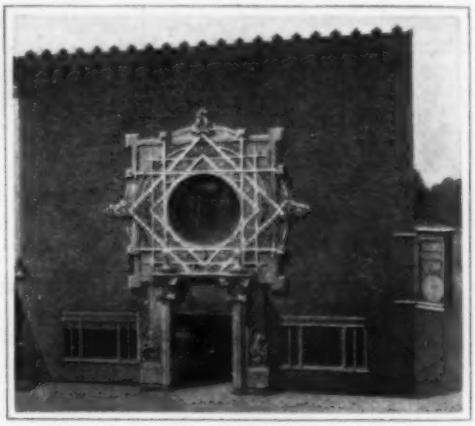
CURIOUS PLEASURE VEHICLE DESIGNED FOR CHILDREN

Built entirely of metal in a light but apparently substantial form, a five-wheeled velocipede has been devised as a pastime vehicle for children. The fifth wheel, which is the driving member, is mounted in the middle and supplied with foot pedals similar to those of a tricycle. A fixed-geared steering column, which allows the conveyance to be guided in the same manner as a motor car, is employed. It is easily operated and is capable of good speed.

The Velocipede is Lightly and Substantially Built and may be Pedaled Easily by a Small Child

ODD ARCHITECTURAL DESIGN IN BUSINESS BUILDING

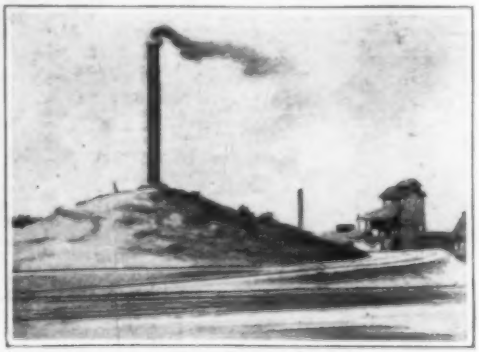
Quite an odd effect has been attained in a bank building erected at Grinnell, Ia., in which the architect has striven to create an atmosphere of age. Except for two broad panel windows, set on either side of an elaborately carved stone entrance, which is surmounted by a rose window, the front of the structure has no openings. The roof of the building is made almost entirely of glass, so that the interior lighting is not impaired by a lack of apertures in this wall. Except for the parapet and the ornate decorative work about the rose window and entrance, the brick façade is perfectly plain. The inside is finished in natural brick and trimmed with oak.



A Glass Roof Covers the Building, so That the Interior is Lighted Adequately

HIGH SMOKESTACK BUILT THROUGH HILL

In erecting a tall smokestack at an Arizona smelter a simple method of construction was adopted. Adjacent to the plant is a small knoll. A tunnel was excavated to the middle of this

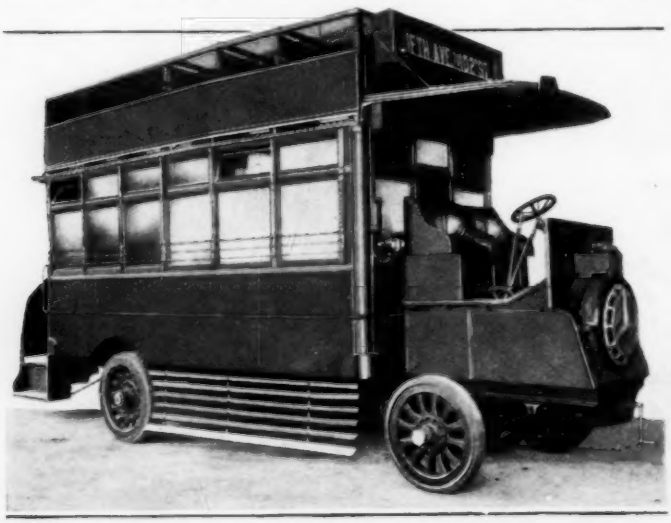


Tunnel Extends from the Smelter to the Middle of the Hill

and a shaft sunk from the top of the hill to connect with it. This passage was then lined and a steel stack built at the summit. This provided a very substantial stack requiring little or no bracing and one with only two-thirds as much metal construction as would have been necessary had it been built on the level.

MOTOR-BUS SIDE FENDERS GUARD REAR WHEELS

Longitudinal fenders designed to prevent pedestrians from being caught by the rear wheels have been installed on a large number of motor busses operating in New York City. The guards are made of wooden slats mounted at the sides of a car below the body, so as to span the greatest part of the distance between the front and rear wheels. At first sight the purpose of a fender of this character might not be apparent. The reason for it is that an analysis of the statistics covering motor-bus accidents in New York and London showed that in the majority of cases pedestrians heedlessly walked against the sides of the cars, with the result that their feet or legs were caught by the rear wheels.



Fenders of This Type have been Fitted to Motor Busses Operating in New York City to Prevent Pedestrians from Stepping in the Path of the Rear Wheels

HITCHING POSTS EQUIPPED WITH PUSH BUTTONS

As a convenience for its customers, many of whom are farmers, a grocery company in Lexington, Ky., has equipped each of the iron hitching posts in front of its establishment with an electric push button. Before these push buttons were installed, country customers driving up to the establishment with nervous horses which they were afraid to leave, were sometimes compelled to wait a considerable time before attracting the attention of a salesman. All the buttons are on the same line, and when any one of them is pressed it sounds a buzzer which can be heard all over the store and which attracts immediate attention. Current is supplied by dry batteries.

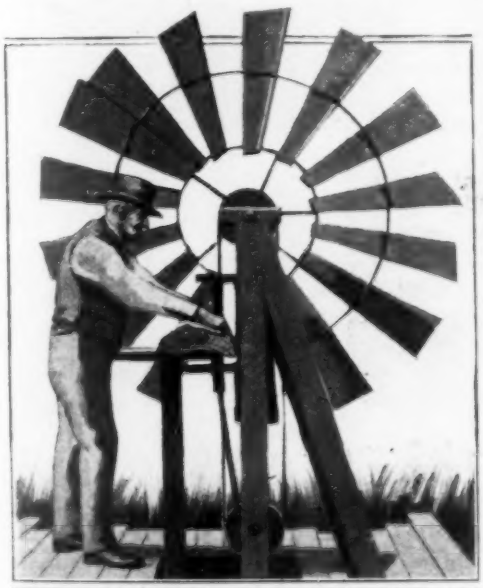
VENTILATE FACTORY PLANT THROUGH COLUMNS

In a new factory building recently constructed for a Baltimore company, the distributing ducts of the ventilating system have been placed in the hollow steel-concrete supporting columns. The operating units are installed in a penthouse on the top of the structure, and leading from this across the roof are the main supply pipes which carry air to the column ducts. Because of the double purpose they were to perform, the interior columns were not made after the usual pattern, but formed by placing two built channels together and concreting them. The hollow spaces thus provided permitted the installation of galvanized-iron pipes which were subsequently incased in concrete. The ducts decrease in circumference downwardly so that they are proportioned to the

volume of air they are expected to carry at the various vents, which are provided at each story. The taper form of the ducts also provides for the increasing of the concrete area as the load becomes greater.

ODD SAWMILL OPERATED BY WIND POWER

On the shore of San Francisco Bay there is a curious, homemade sawmill which is owned by an aged man who collects the driftwood tossed up by the surf, cuts it into stove lengths, and makes his livelihood by disposing of it. It is a wind plant and has been built by its owner solely from odds and ends salvaged from near-by dumps. It consists of an upright wooden frame supporting a medium-sized windmill wheel that may be adjusted to suit the various changes in the breeze and which operates the blade of an old bucksaw mounted in a vertical position. The wind blows almost constantly from across the bay and furnishes enough power to keep the little plant working.



The Wind Sweeps In from the Bay, Providing Plenty of Power to Operate the Crude Sawmill

MAN MAROONED ON CHIMNEY SAVES SELF IN ODD WAY

While four workmen were engaged in making repairs at the top of a 125-ft. brick chimney adjacent to a power plant, an accident occurred which tore away the staging on which they were standing and precipitated three of them into the shaft. By very quick action one of the men managed to obtain a grip on the top bricks of the stack and draw himself on the wall, which he then straddled. The fire department was called upon to rescue him from his perilous position, but it was without a ladder which would reach to the required height. About eight feet below the top of the stack was the first step of an iron ladder which extended down the chimney. Seeing the rescue party fail in its attempts to save him, the marooned man commenced to remove the bricks from the chimney and cut a hole down the wall to this ladder. When he reached the first step he found that it was so loosely set in the bricks that it would not bear his weight, so he worked downward to the second one.

Marooned at the Top of This Chimney, a Workman Saved Himself by Removing the Bricks and Cutting His Way Ten Feet to the Iron Ladder

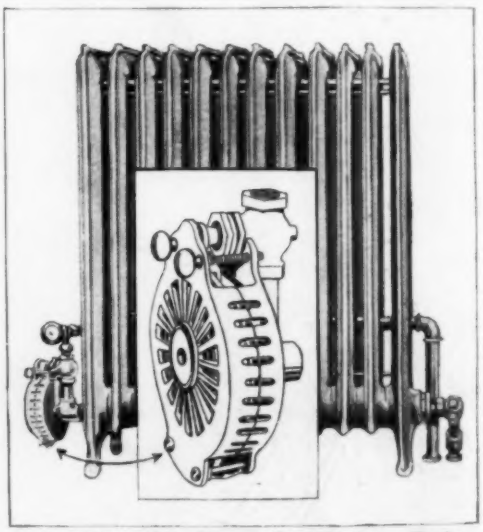
MOTOR-DRIVEN CHURN BUILT AS FARM CREAMERY PLANT

For farm and dairy purposes a small, power-propelled churn has been introduced which is a complete butter-making plant in itself. It is intended to provide the average farmer with an efficient, quick, and economical facility for manufacturing butter on a small scale without the time consumption and hard labor which attended the old hand methods of churning. In this instance the cream is poured into the machine and the motor started. The rest of the operation is mechanical. The cream is ripened and churned into butter, the latter worked, the proper amounts of moisture and salt incorporated in it, and the process completed in less than a half hour. When the churning operation is ended the milk is drained through a strainer, which retains the butter fat. The motor is then changed into low gear, starting the rollers. These are contained in a basket arrangement inside of the barrel and may be adjusted to handle different amounts of butter. When the work is finished the product lies in a collected mass in the basket, from which it may be readily removed and packed.

The Machine may be Operated Either by a Gasoline Engine or an Electric Motor

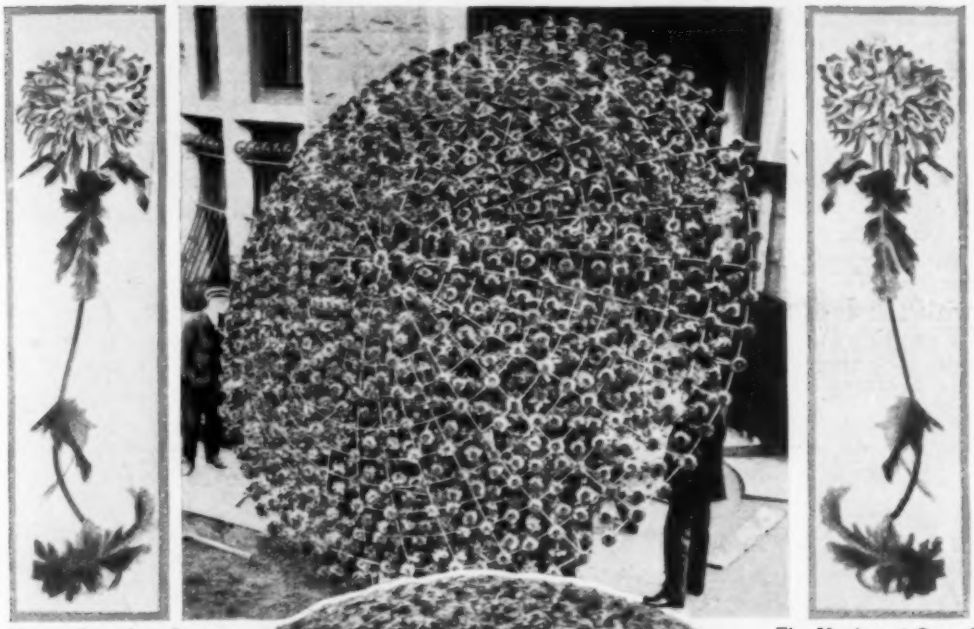
HEAT REGULATOR DESIGNED FOR STEAM RADIATORS

By the invention of an adjustable thermostatic controller which is intended to be attached to a steam or hot-water radiator, a simple means of maintaining a room at a nearly constant temperature has been devised. The plan of the instrument is such as to make it possible to keep separate rooms in a house at different temperatures when illness or other conditions make this desirable. The device is only a few inches in height and is not objectionable in appearance. The thermostat consists of two corrugated silver disks which are hermetically joined. The hollow space provided between these drums is filled with a gas, the expansion and contraction of which turns on and off the steam when the heat in a room drops below or rises above predetermined points. A shield is provided which protects the thermostat against the effect of heat given off from the radiator.



By Installing a Controller on Each Radiator, Various Rooms may be Kept at Different Temperatures

PREPARING BUSH CHRYSANTHEMUMS FOR EXHIBITION



Above: One of the Largest Bush Chrysanthemums Grown in This Country

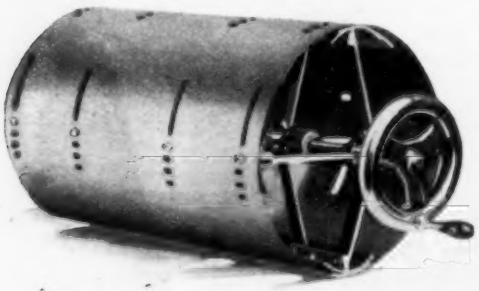
The Moving of One of These Big Plants Presents a Real Problem

There is nothing more spectacular at New York's autumn flower shows than the immense potted bush chrysanthemums, which never fail to win unstinted admiration. These extravagant specimens of skillful plant culture are sometimes more than 14 ft. in diameter and present as many as 1,400 blossoms. Weeks of care and daily work are required for their training and final preparation for exhibition. In doing this one of the most successful growers selects three of the most uniform plants available and places them in a 24-in. tub, in which the soil has been fertilized and specially prepared. A wooden stake is driven into the center of the pot and cut off about four feet above the soil. Four round iron rods approximately 10 ft. in length, their centers crossed, are then laid over the tub and their ends fastened to the rim. A ring of heavy wire is subsequently made to encircle the frame formed by the bars. This forms the foundation for the elaborate framework which is gradually built up to support the myriad of blooms. As the work goes on, the plants are taken down all around and the longest growths tied evenly to the wiring on all sides. The short stems are held up toward the center by cords attached to the middle stake. As these latter growths develop they are tied down, the frame

being expanded in circumference by the addition of encircling wires as necessity dictates, as well as closed toward the center. The ribs of the frame consist of pieces of heavy wire passed from one edge of the circle to the other, resting on the stake, to which they are secured. Longitudinal wires of smaller size are fastened to these supporting members, eventually giving the frame the form of a hemisphere, which is subsequently painted a foliage green. The final tying is done in the bud stage with the tops 2 in. above the wiring. When this is done and the flowers open out, each turns its head upward toward the sunlight.

ADJUSTABLE CONCRETE MOLD FOR SEWER WORK

Designed so that it may be expanded to various sizes, or collapsed, a metal form has been invented for facilitating the construction of concrete culverts and sewage mains. It is made in cylindrical form, is about 10 feet in length, and may be readily adjusted to any diameter between 18 and 60 in. The drum is made of a lapped piece of sheet metal held in shape by a series of arms that may be extended or contracted by revolving a crank provided at one end of the device. When the form is to be used it is set at a certain diameter and the concrete then poured about it. When the latter has had adequate time to set, the diameter of the drum is decreased and the form



The Cylinder may be Expanded to Various Sizes by Operating the Crank at the Right

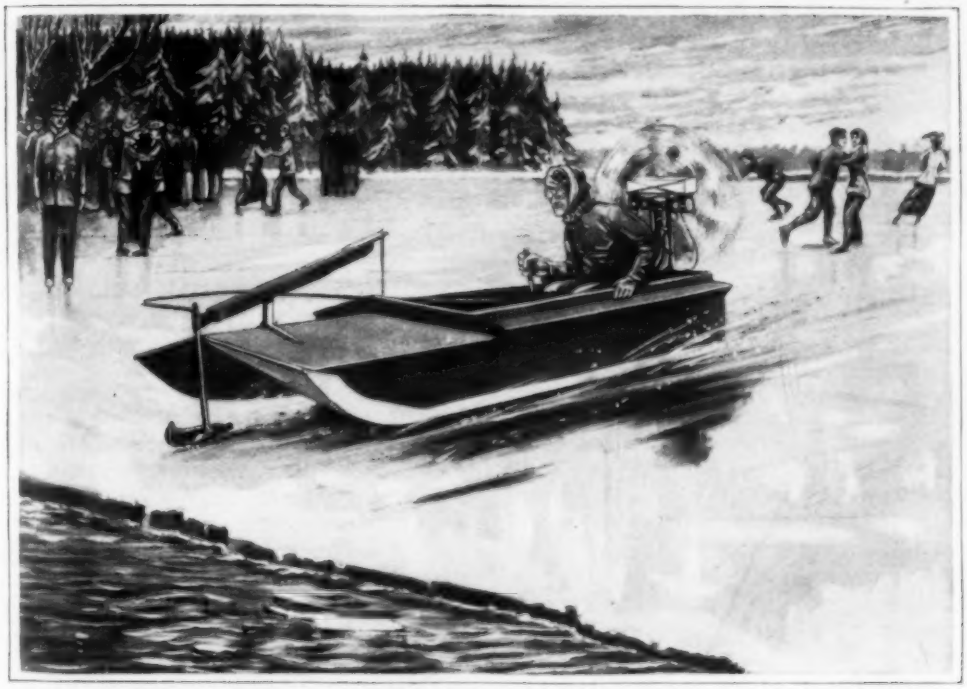
withdrawn. A conduit of any length may be constructed by building it segment by segment, each time leaving just enough of the cylinder in the mouth of the previously laid section to provide for a joint. In addition to its convenience, the device saves the time of wood-form construction.

CIRCULATING ART EXHIBIT IS EDUCATIONAL IDEA

In the hope of raising existing standards and stimulating a deeper appreciation of art within their state, the club women of Wisconsin are promoting a noteworthy educational scheme. By applying the plan of the circulating library and university extension course to an exhibit of paintings, they are making it possible for every community in the commonwealth to enjoy the collection, which is composed of some 75 paintings representing the work of about 40 native artists. For the reasonable fee of $5, plus transportation charges, any individual or municipality may procure the paintings and display them for one week. As is true in every state, there are many villages in Wisconsin which hold groups of individuals who have never been afforded an opportunity to see original canvases of merit, and it is this class of people that the women particularly desire to reach. The idea also furnishes a means of helping state artists by making their works known and enlarging their coterie of admirers. Approximately 35 cities and towns have already applied for the loan of the exhibit.

COMBINATION BOAT IS MADE FOR ICE AND WATER USE

In order to navigate Lake Pend Oreille during the winter months when its upper part is frozen and the southern half open, an Idaho boat builder has constructed a craft which is designed for both water and ice. It is driven by an aerial propeller and is capable of gliding rapidly over smooth ice, taking to open water at full speed and then running back onto the ice when making the return trip to the northern part of the lake. The



Peculiar Craft Adapted to Navigate over Both Water and Ice, Built for Use on Lake Pend Oreille during the Winter Months

boat is 14 ft. in length and approximately 4 ft. wide. Its bottom is shaped like an inverted V, quite similar to that of the average hydroplane, which allows it to ride high in the water. At its stern are two skatelike runners and at the bow a single one to which a control lever is attached for guiding the craft when it is used as an ice boat.

NEW FORM OF COPY HOLDER FOR TYPEWRITER

Several convenient features are incorporated in a copy holder which has been introduced as a typewriter attachment. It is designed to be mounted securely at the back of a machine and consists essentially of a substantial frame that supports a platen and gauge. A key, which when struck spaces the roller, is fixed to a lever that extends along the right side of the machine. Copy of any character may be placed in the device, which obviously is in front of the operator. This is one of the especially convenient points, for the copy is thus supported in the logical place, in the line of direct vision, so that the strain of keeping the neck craned to one side hour in and hour out, as is usually necessary, is eliminated. Another feature is that the device makes it nearly impossible to miss a

The Copy is Held Directly in Front of the Typist

line when transcribing and, furthermore, does not make it necessary for a typist to look twice to locate his place.

FOUR YEARS *in the* NAVY—

PART III
THE REWARDS OF NAVAL TRAINING

BY LOUIS E. BROWNE

TRAVEL is an advantage of the naval service. The Navy Department, whenever possible, sends every ship abroad once a year to give the men from five to ten days' shore leave, with about six weeks' pay to spend. On the cruise to the Mediterranean in 1913 hundreds of bluejackets spent nine days touring Italy, France, Austria, and Switzerland. The Atlantic fleet, the organization of all of the active battleships of the United States, spends the winter at Guantanamo, Cuba; Colon, Panama; and Pensacola, Florida. In April it comes north for target practice off the Chesapeake capes and battle maneuvers off Newport, Rhode Island.

In port, when practicable, one-half of the crew may go ashore after three o'clock in the afternoon to return aboard before eight the next morning. Forty-eight and 72-hour furloughs are granted frequently. Ships are usually in their home ports at Thanksgiving and Christmas. Ten days' leave is granted during the latter holidays. Civilian clothing is forbidden, but when ships are in port for any length of time, many men rent rooms and keep "cits" in them, which they wear during shore leave.

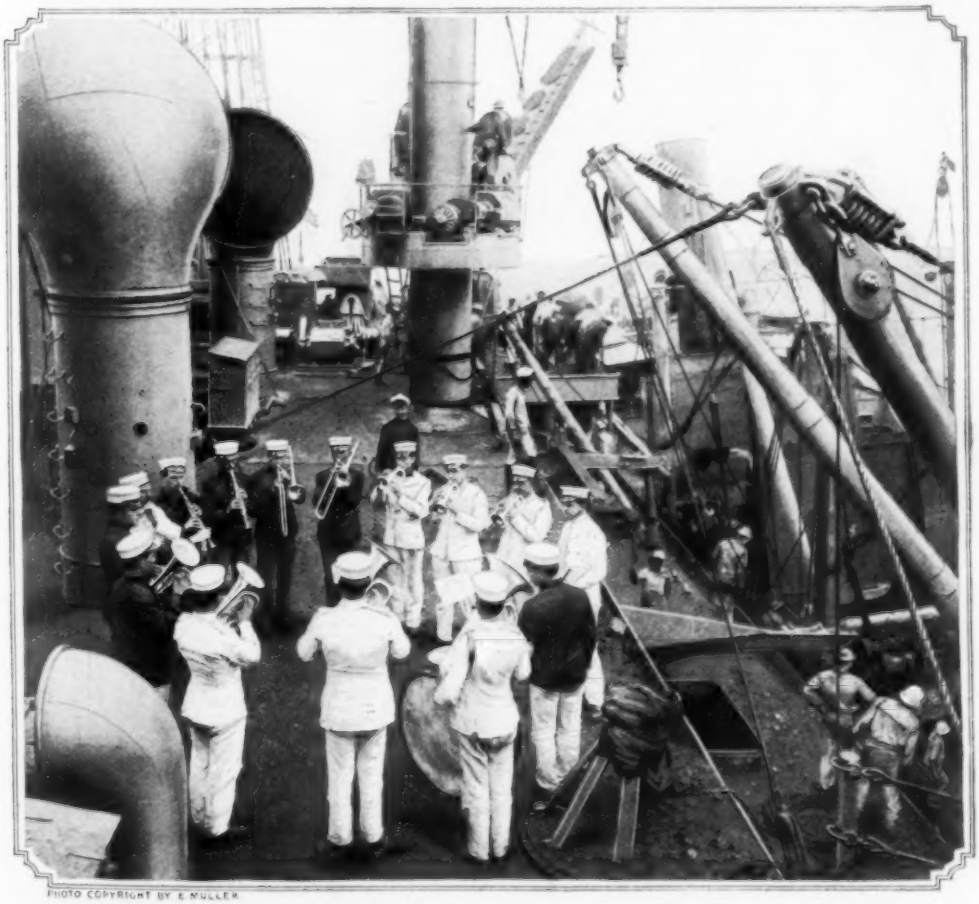
There are fully equipped sick quarters, operating rooms, and a corps of surgeons and nurses on each warship. Men report at 8:30 and 5:00 (sick call) for treatment. Every ship has a government savings bank. The sailor has a pass book and is allowed four per cent interest on money deposited. On request, a portion of the sailor's pay will be sent home or to a private bank by the paymaster-general through the navy allotment office on shore. The canteen supplies the bluejacket with tobacco, sweetmeats, toilet articles, souvenirs, etc. Divine service is held on Sunday mornings when the weather permits. The chaplain conducts the service of the church of which he is a member. Attendance is not compulsory. The Naval Y. M. C. A. has buildings at all of the navy yards and naval stations and frequent meetings are held in the crew's space on shipboard.

Officers have living quarters (the wardroom) in the extreme bow of the dreadnaughts and far aft in the old ships. The bluejacket is not permitted to loiter on the deck above the wardroom; likewise officers are supposed to keep out of the men's part of the ship. Men must salute commissioned officers on shore but not on shipboard unless they wish to address them, when remarks must be prefaced by "sir." Chief petty officers have quarters and a mess of their own, but are entitled to neither a salute nor a "sir." At sea regulations are relaxed.

In bad weather hatches are battened down and the air below decks gets unbearably foul, but officers and men must endure it for days at a time. All bluejackets wish to be members of a boat's crew, for at sea they may sleep in their boats; which insures plenty of fresh air and eliminates the bother of lashing and swinging hammocks. Rough weather endangers the boats, and then the men are ordered below.

Naval discipline is rigid. The captain is judge and jury; his court is called "mast." Desertion, disobedience, overstaying leave, and the use of intoxicants are the most numerous service offenses. Misdemeanors, such as smoking out of hours, wearing dirty clothes, or out of uniform, are disposed of with loss of liberty, extra duty, and a warning. Constant offenders are punished by confinement in the brig—a ship's cell—on bread and water for a week or more, with full rations once every third day. More serious offenses, such as desertion, theft, insolence, and assault, mean a court martial which can sentence the offender to prison; to the disciplinary barracks; deprive him of rank and several months' pay; or give him a "kick out"—that is, a dishonorable discharge from the service.

The disciplinary barracks are at Port Royal, S. C., and Puget Sound, Wash. They aim to take old offenders and, through many months at hard labor, never-ending drills, no liberty, and no pay, turn them back into the service wiser men who have had a taste of prison life, without the stigma attached to a prison sentence. Men discharged from the barracks rarely again give trouble. Many of them reënlist. Conviction after a term in the disciplinary barracks for a serious offense, means a prison sentence. During the past



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Coaling Ship Is a Strenuous Proceeding, But is Made a Sort of Gala Occasion by the Bluejackets. It Is Customary in the Navy to Accompany This Work with a Band Concert

year the plan of substituting disciplinary ships for disciplinary barracks has been tried, and it is likely that this arrangement will be made permanent as a means for disciplining and reforming the men, especially the younger bluejackets, whose offenses have not been of a serious nature. The "Topeka," stationed at the Portsmouth, N. H., Navy Yard, is now being used for this purpose. The men sentenced to this ship are known as detentioners. They are subjected to constant drill and instruction, but not to hard labor, or other prison conditions.

"Short-timers" are detached from the fleet and sent to destroyers, submarines, and cruisers to complete their enlistment. Life on these craft is vastly different from that of a battleship. Discipline is much more free; the men sleep in bunks; the quarters are extremely cramped; and it is nearly impossible for men to keep their uniforms clean. Duty on submarines means increased hours, but also increased pay. During the last year of enlistment a bluejacket is often given short duty if he signifies intention of reënlisting. Second-enlistment men are often ordered to the Philippines, Hawaiian Islands, or the China coast. These billets are widely sought. Duty in the Canal Zone and on gunboats doing tropical duty is not attractive to the bluejacket.

A chief petty officer who has been in the service seven years may obtain warrant rank if he passes the required examination. This grade pays from $1,500 to $2,400 a year. Any bright man, who will study, can reach this grade. From warrant officer the enlisted man may be promoted through the various ranks of commissioned officers—but these promotions are rare. Unless a man becomes a petty officer before the expiration of his first enlistment, he is advised to remain in civil life. Out of 51,000 men in the service, 16,000 are petty officers.

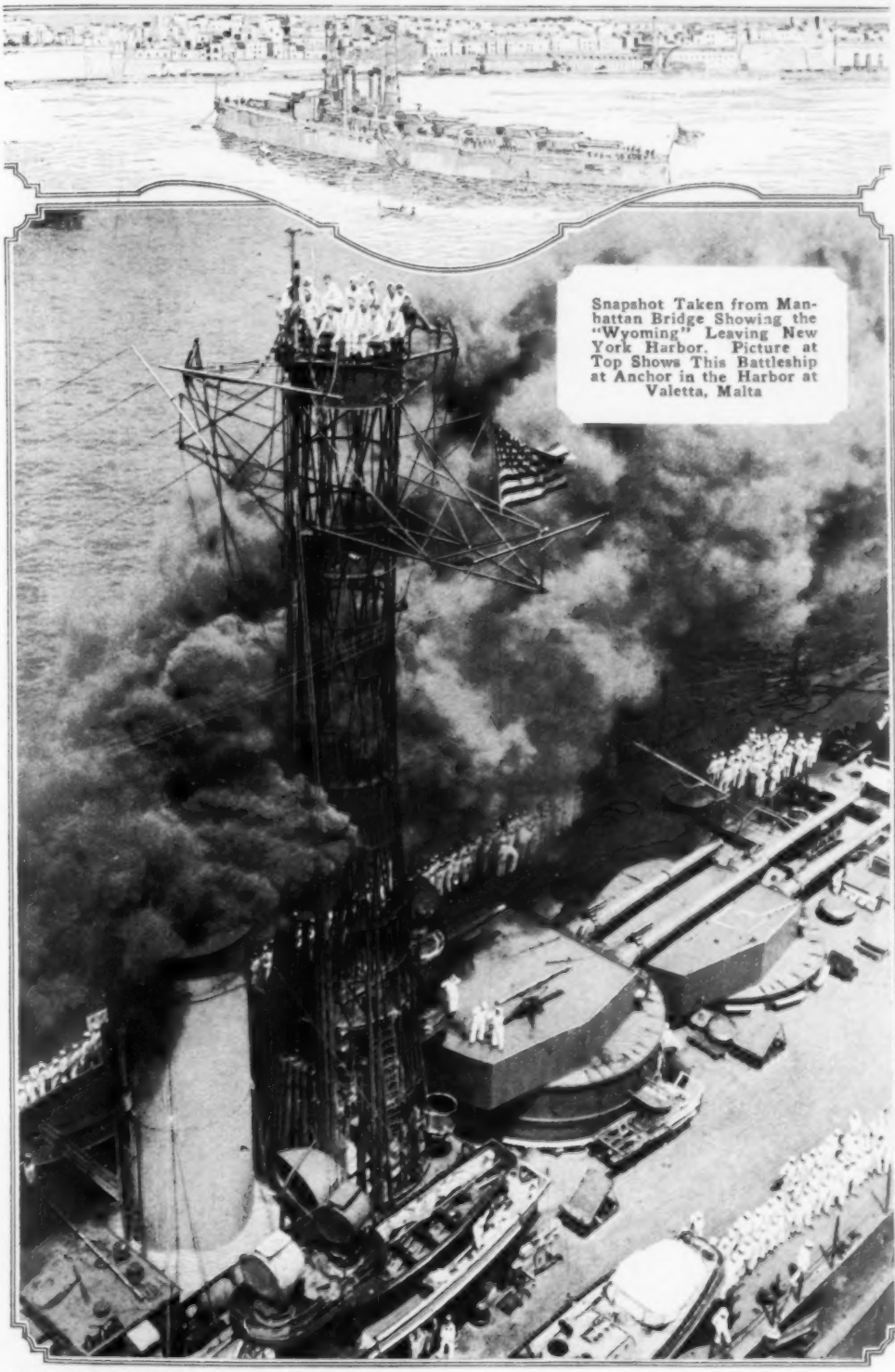
Promotion is made easy for the deserving man. When a bluejacket completes his first enlistment he is given four months in which to reënlist, with continuous pay. A reënlisted petty officer, under thirty years of age, with a good conduct record, may attend the Seaman Gunners' Schools, at Washington, D. C., or Newport, R. I.; or the Machinists' School, at Charleston, S. C., if he passes the examination. The courses are six months long. At the former schools the sailor learns to assemble guns and breech mechanism; the manufacture of shells and powder; the construction of storage batteries; deep-sea diving; he takes a course in metallography. In Washington the bluejacket works several hours a day in the great naval-gun factory; in Newport he learns all about torpedoes and mines; at Charleston he has instruction in bench work; working with machine tools, marine engines, etc. Besides technical subjects, many hours a week are spent in the class rooms with academic subjects. The routine is rigid. Reveille is at 5 A. M., and during the day, except on Wednesday and Saturday, there is a two-hour infantry and field-artillery drill. These schools put the man in line for promotion.

After 20 years' service, a sailor physically disqualified may retire on one-half pay; after 30 years' service, he may voluntarily retire on three-quarters pay, plus $15.75 in lieu of rations, clothing, and quarters. Service in the army and marine corps is counted; war service counts double time.

A "big ticket" is an honorable discharge at the end of an enlistment with a recommendation for reënlistment; a "small ticket" is a discharge without the recommendation, or a bad-conduct discharge; and a "kick-out" is a discharge for the "good of the service." In the last case the man is brought to the quarter-deck, and his hatband and the white stripes from the blouse of the uniform are ripped off by a master-at-arms in the presence of the officer of the deck.

Upon the death of an enlisted man, from wounds or disease incurred in the line of duty, an amount equal to six months' pay is forwarded to his widow, or other previously designated beneficiary.

FOREIGN TRAVEL A FEATURE OF LIFE IN NAVY



Snapshot Taken from Manhattan Bridge Showing the "Wyoming" Leaving New York Harbor. Picture at Top Shows This Battleship at Anchor in the Harbor at Valetta, Malta

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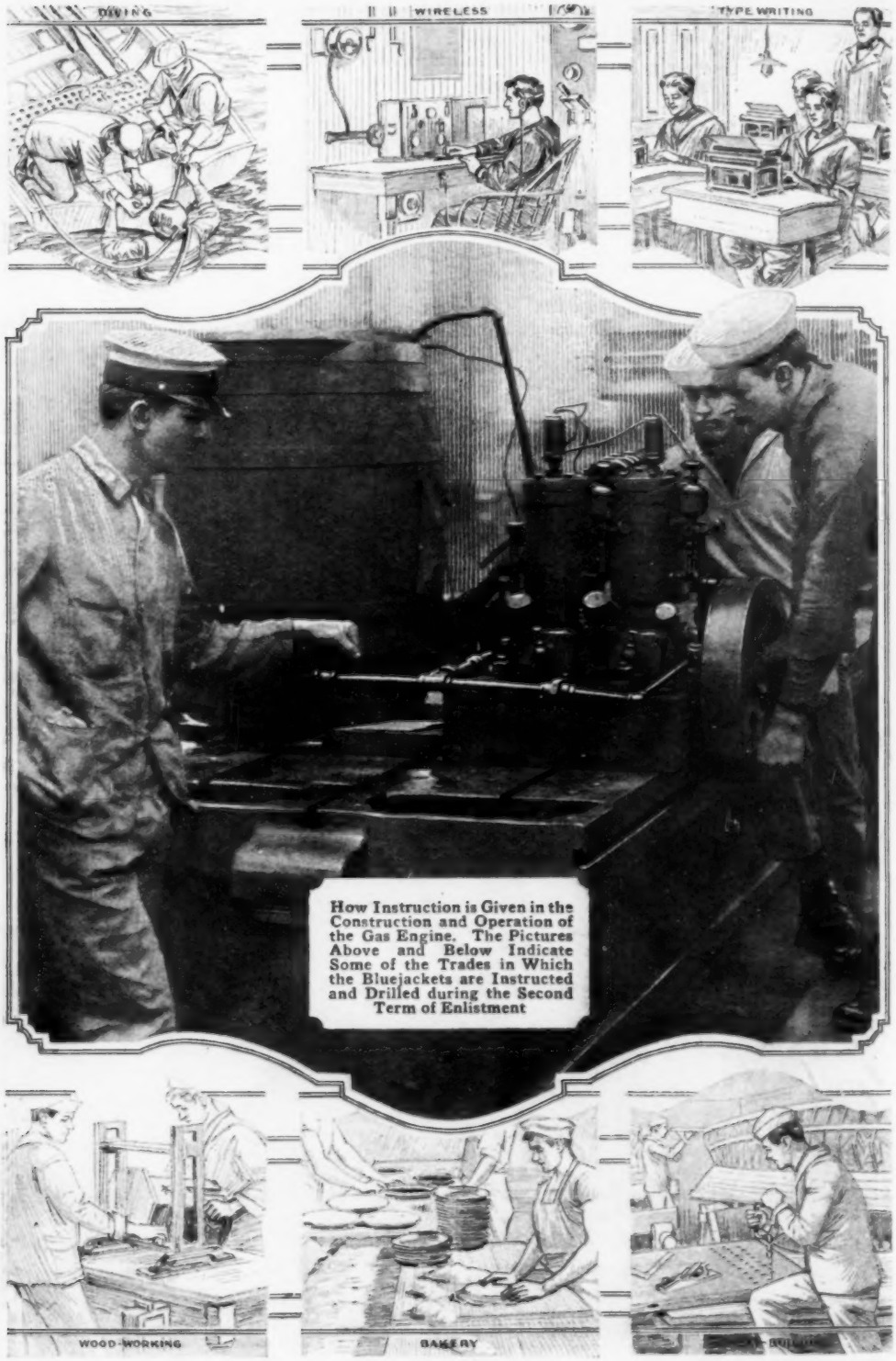
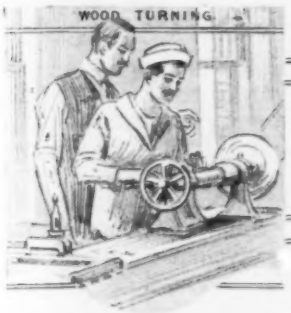
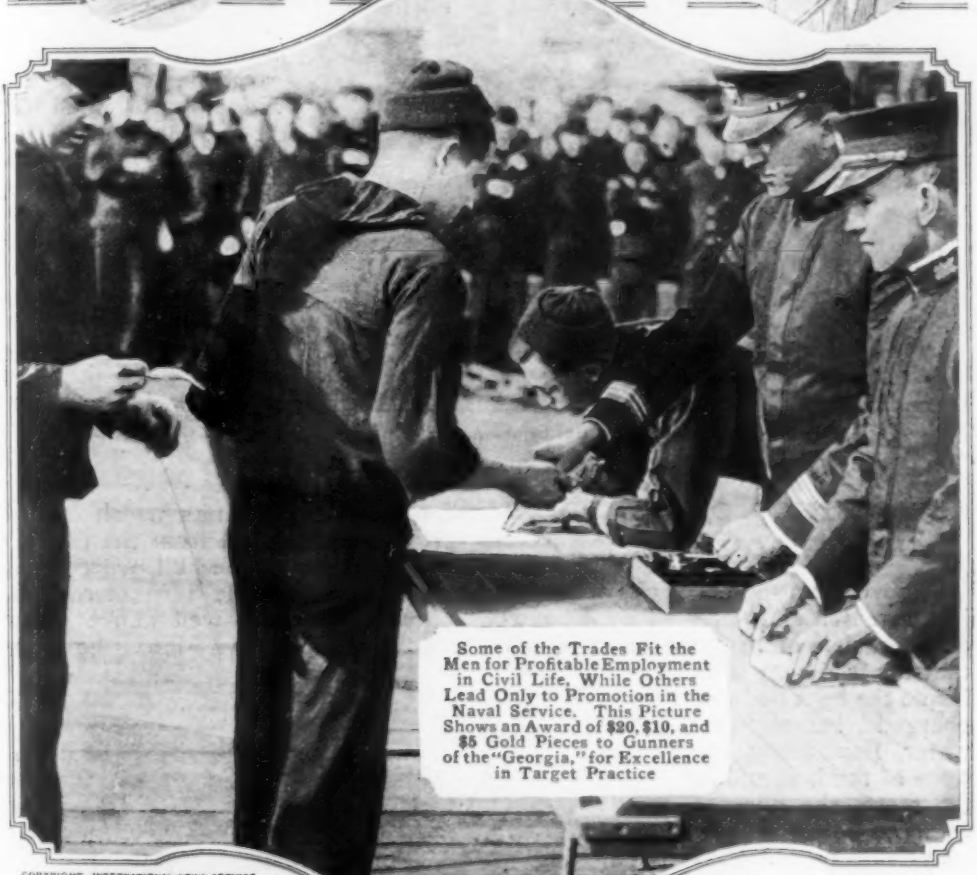
ONE OF THE REWARDS OF THE SERVICE IS THE



How Instruction is Given in the Construction and Operation of the Gas Engine. The Pictures Above and Below Indicate Some of the Trades in Which the Bluejackets are Instructed and Drilled during the Second Term of Enlistment

OPPORTUNITY FOR ACQUIRING A USEFUL TRADE





Some of the Trades Fit the Men for Profitable Employment in Civil Life, While Others Lead Only to Promotion in the Naval Service. This Picture Shows an Award of $20, $10, and $5 Gold Pieces to Gunners of the "Georgia," for Excellence in Target Practice

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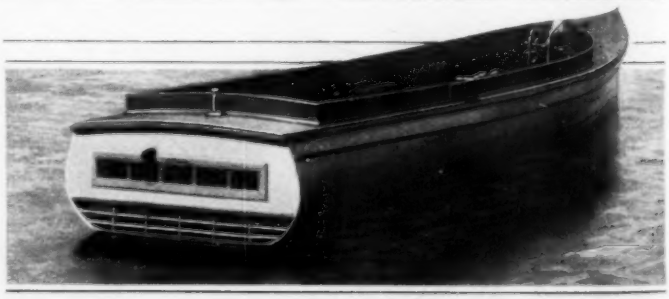
WINTER-LANDSCAPE ARTIST HAS PORTABLE STUDIO

A Minnesota artist who devotes much attention to winter landscapes in the North, has devised a portable studio which enables him to carry on his work during very severe weather. The outfit consists of a miner's tent which is provided with a large window in one side and a wooden flooring to which the ends of the canvas are secured. This small shelter, which affords only enough room for an easel and chair, in addition to a small oil stove and provision bag, is sometimes packed on a sled and at other times rolled into a bundle which he straps to his back in much the same manner as a haversack. With this and his snowshoes, or skis, when they are necessary, he starts out for his day's work.

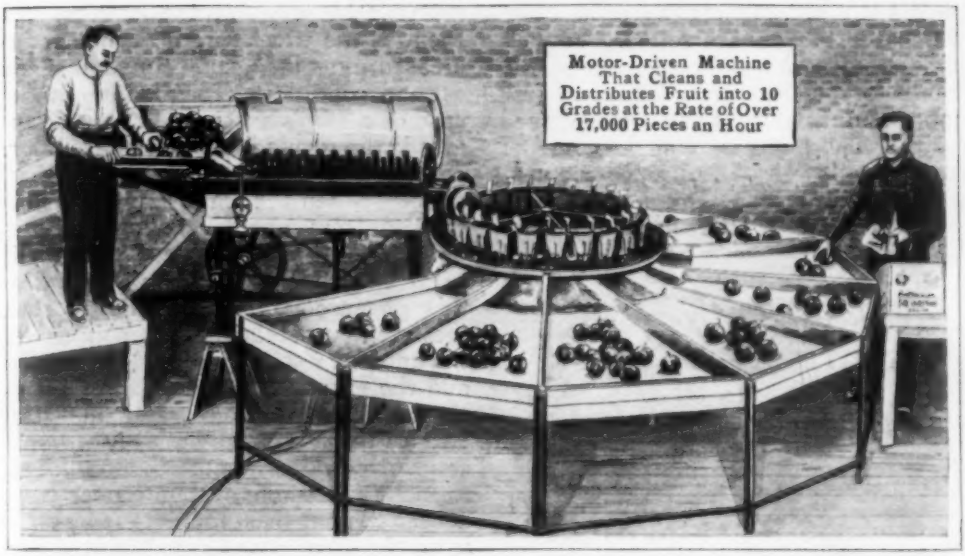
The Tent Studio Ready for Use by the Artist

NEW METHOD OF PROVIDING AIR CUSHION FOR BOAT

A novel feature in boat construction, just invented and patented by a Canadian, consists of air passages so placed that air is drawn from inside the boat and discharged below the water line along the sides of the hull and at the stern, the purpose being to do away with skin friction and with suction at the stern. The passages along the sides consist of pipes leading downward and backward from the cockpit and cabin. Each of these pipes is fitted with a valve which is closed when the boat is at rest and is opened by the suction of the water and the air pressure when the boat is in motion. The stern is fitted with a set of rectangular conduits which extend vertically downward from the deck to the lower part of the hull, where each makes a right-angle turn sternward. Through openings well above water level, air is drawn into the conduits and is discharged below the water line, the idea being to overcome suction by preventing the water from being drawn in behind the boat, and thus avoid the drag caused by suction.



Boat Arranged for Discharging Air under the Sides and from the Stern



Motor-Driven Machine That Cleans and Distributes Fruit into 10 Grades at the Rate of Over 17,000 Pieces an Hour

MACHINE FOR CLEANING AND GRADING FRUIT

A motor-driven machine for cleaning and grading fruit, that has just been brought out in Oregon, is capable of handling apples, peaches, pears, oranges, and lemons, and of distributing them into 10 grades at the rate of over 17,000 pieces an hour. The fruit is first fed into the cleaner where it is thoroughly cleaned by revolving brushes made of hog bristles, and from this machine it passes automatically to the grader. The grader is built in circular form and occupies a space about 13 feet in diameter, the outer part consisting of a sloping table which is divided radially into bins for receiving the different sizes of fruit as it is graded. The center of the machine is occupied by a revolving plate on which are 24 cups, each of which, as it passes under the discharge apron of the cleaner, receives one piece of the fruit. At the point where the fruit is received the cup is practically closed at the bottom. The opening at the bottom of the cup is controlled by two cam rails in such a way that it gradually widens as the cup swings round the circle, and at a point over the proper bin this opening becomes large enough to allow the fruit to drop. The cups and other parts of the machine with which the fruit comes in contact are lined with felt so that there is no danger that the fruit will be bruised during either the cleaning or grading process. The machine is intended to be driven by an electric motor or a gasoline engine.

PORTABLE BARREL DRAINER OF CONVENIENT FORM

To make easier the work of draining oil barrels, a special apparatus has been brought out which facilitates the handling of large casks and tends to eliminate waste. The drain is constructed of galvanized steel and is fitted in an iron frame which is mounted on casters. Extending to the front

The Drain Pan Fits in a Frame and may be Removed Readily if Desired

of this is a notched incline, or skid, up which the barrels are rolled. Four 6-in. casters attached at the top of the frame form a bed for a barrel to rest upon and enable it to be revolved easily. The bung is removed and the contents allowed to drain into the pan, which feeds into a tank beneath. A curved apron at the back prevents splashing.

STREET KIOSKS ARE LEASED BY CITY OF BALTIMORE

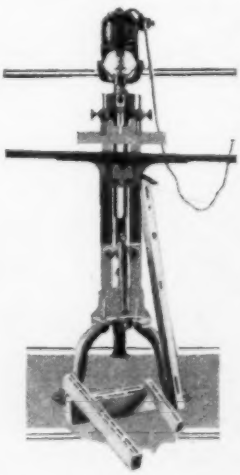
As a method of handling the street-vending question at Baltimore, the municipal authorities have had a number of kiosks constructed at the intersections of different business thoroughfares and have rented them to the highest bidders. These little booths, which are not much larger than the ticket offices of small motion-picture theaters, are set near the curb lines on the sidewalks. They are used as newspaper, candy, tobacco, and fruit stands. Two of them were opened July 1. One of these, erected at the corner of Holliday and Baltimore streets, was rented for $35 a month. The structures are neatly and substantially built.

GROUND RESISTANCE IN WIRELESS ANTENNA

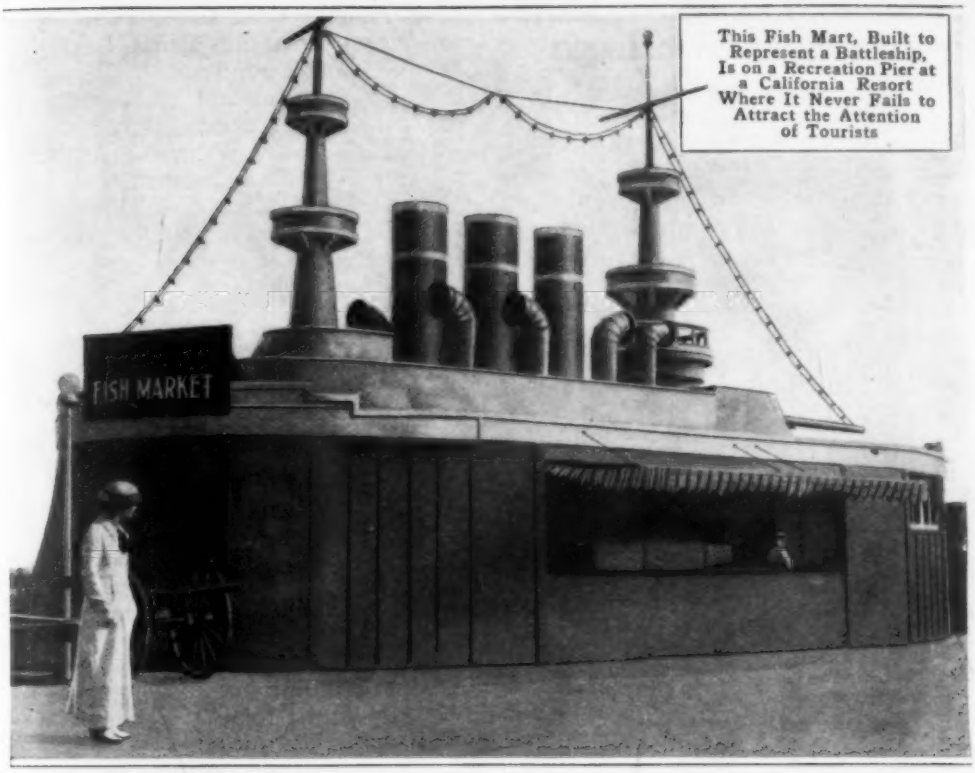
Ground resistance in the antenna is one of the vagaries of wireless operation for which no satisfactory explanation has yet been found. The total resistance, which includes the ohmic resistance of the wires, the radiation resistance, and the ground resistance, falls rapidly as a short wave length is replaced by longer wave lengths, and then, as the wave length is further increased, remains nearly constant if the ground conditions are good, as in the case of a ship's antenna, but rises rapidly if the ground conditions are poor. In one case this resistance more than doubled when the wave length was increased from about one-half mile to one and one-fourth miles. Although great difficulty is found in explaining this phenomenon, it is believed that the antenna system acts as a condenser, the antenna itself being the upper plate and the ground water the lower plate. Between the ground water and the surface there is usually a layer of semi-conducting material of such a nature as to make the whole system a poor condenser. It has been found that by covering the ground under and around the antenna with a wire net, thus making the wire net the lower plate of the condenser, the ground losses nearly disappear.

BORING ATTACHMENT FOR MORTISING MACHINE

An arrangement for using a chisel-boring device with a foot-power mortising machine has recently been invented and patented. The device used is the ordinary hollow chisel bit. It is driven by a ¼-hp. electric motor that makes 2,600 revolutions a minute.



¶In the latest annual report of the Sanitary District of Chicago an expenditure of nearly $5,000,000 for bridges is reported, this expenditure covering 13 bridges over the Chicago River and 15 bridges over the main drainage canal.



This Fish Mart, Built to Represent a Battleship, Is on a Recreation Pier at a California Resort Where It Never Fails to Attract the Attention of Tourists

SHIPLIKE BUILDING USED AS FISH MARKET

On the principal recreation pier at Venice, an ocean resort in California, is a curious fish market roughly built to represent a battleship. It is fitted with fighting tops, funnels, and ventilators, and at the bow and stern mounts long, realistic-looking rifles. On the promenade side is a shaded opening, across which a counter is extended, while on the ocean front are portholes which furnish sunlight for the interior during the daytime. Instead of being decked with flags, the "boat" is decorated with a string of colored electric lights which identify it from both the water and pier sides when illuminated at night.

¶ Firing a set of blasts simultaneously is estimated to be about 25 per cent more effective in breaking rock than firing the blasts one at a time.

INSTRUMENT FOR CLEANING EYEGLASS LENSES

For cleaning eyeglasses easily and quickly, a convenient device has been perfected. It is a folding instrument that is provided with two tweezerlike blades which mount disk-shaped chamois buffers at the ends. A lens is slipped between these two members, which are pressed firmly against both sides of a glass by a slight pressure of the thumb and forefinger, and readily freed from oil and dirt. The prongs fold into a receiving space, provided in the handle of the instrument, much the same as a blade folds into the handle of a penknife.

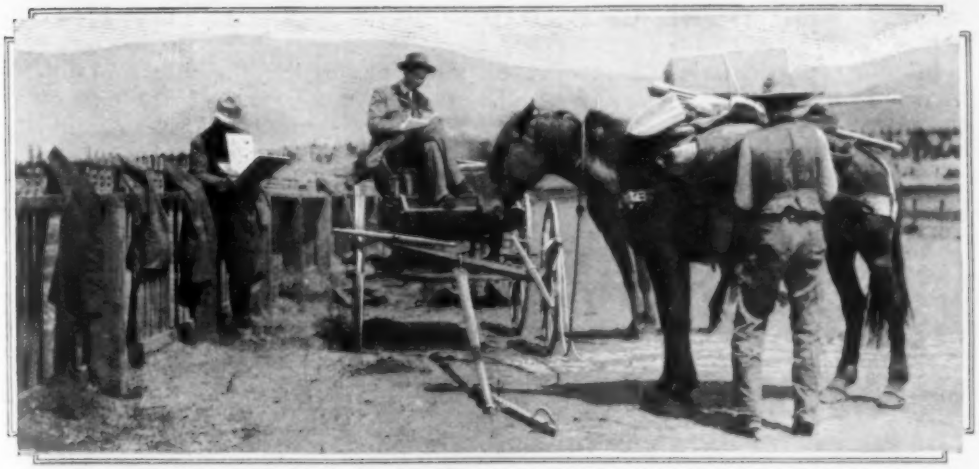
RECORDING THE MOVEMENTS OF A WORKMAN'S HAND

With a new apparatus that has been developed by an efficiency expert every movement of the hand as it manipulates a machine or tool, or performs other work, is accurately recorded on a photographic plate, and in this way a reliable means is provided for detecting and eliminating all unnecessary motions. This apparatus is known as the cyclegraph. Its essential features are a miniature electric lamp carried on the hand of the workman and a circuit-breaking mechanism by which this lamp is lighted and extinguished at regular intervals. The lamp is mounted on a ring which is slipped over the finger and is connected with the circuit-breaking mechanism by a flexible, insulated wire. The apparatus that makes and breaks the circuit consists of a wooden disk equipped with half a dozen dry-cell batteries and revolved at a uniform rate by a motor, which is started and stopped by an ordinary switch. Crossing the face of the disk is a copper strip which, as the disk revolves, serves to make and break the circuit of the lamp, with the result that a series of flashes are produced that are recorded as short dashes on the photographic plate. Each dash represents an interval of time, and the string of dashes the trail of the workman's hand. Usually the resulting record looks much like a skein of yarn that has been dropped from the hand. Not only can unnecessary motions be detected by this method, but the inventor is convinced that work of any kind can be standardized by making, with the aid of such records, a wire device that will reproduce the movements that have been found to be the most efficient. With such a guide the apprentice workman would learn the proper motions, not by instruction from another workman, but by following the movements indicated by the wire.

PICKING MEN FOR RANGERS OF GOVERNMENT FORESTS

One of the several accomplishments an applicant for a position as government forest ranger must possess before he can enter the service is an understanding of how to pack a horse. Un-

Record Made by the Cyclegraph: The Tangled String of Dashes Shows the Trail of the Workman's Hand as He Manipulates the Machine



One must Know How to Pack a Horse Correctly Before He can Pass the Civil-Service Examinations of a Forest Ranger

less he can throw a squaw hitch over a pack, balanced so that it won't injure the animal bearing it, or can execute the diamond hitch, his preliminary training is too limited to allow him to pass successfully the examinations. Civil-service tests for forest rangers include many such pioneering tricks as these, and unless a man can assemble a bed, a week's provisions, and various tools, needed for fighting fires and doing other work in the forests, on a horse rightly, his other capabilities are of little help. There are some 2,500 men in the service who know the timber-cutting and grazing regulations, who are hunters of predatory animals, capable fire fighters, woodsmen fundamentally, and of good character.

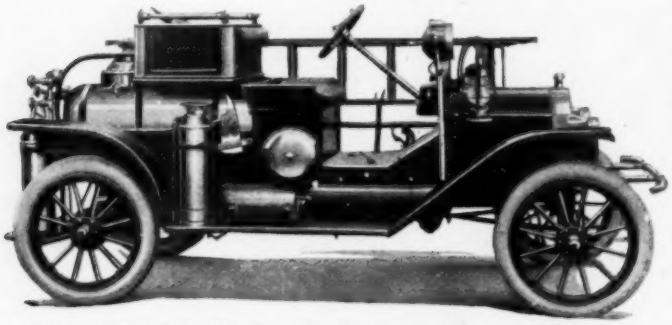
LAMP WITH FOLDING SHADE EASILY TRANSPORTED

An electric lamp which is suited for the drawing room, a den or a dressing chamber, is being made with a collapsible shade which may be used while opened wide, partly closed, or folded pear-shape. It is covered with figured cretonne or heavy silk, giving soft, harmonious color effects, and has a frame which opens and closes the same as an umbrella. The advantage of this, in addition to the various effects which may be produced with it, is that it can be packed compactly for storing, or easily carried in a trunk and taken to a summer bungalow or cottage at the opening of the summer season.

The Lamp Stand is Made Substantially of Brass, While the Shade may be Folded Like an Umbrella

LIGHT CHEMICAL CAR BUILT FOR SMALL-TOWN USE

Intended particularly to meet the needs in suburban districts and small towns where the village fire-fighting paraphernalia is more or less inadequate, an emergency apparatus, consisting of chemical and auxiliary equipment mounted on the chassis of a light, standard motor car, is being built. The outfit, in comparison with the large motor-chemical cars ordinarily used in cities, is moderately priced and if properly cared for should have a low maintenance expense. It is provided with a 35-gal. chemical tank and soda canister, 200 ft. of hose, two 3-gal. hand fire extinguishers and a small extension ladder, as well as pikes and axes. It also mounts a 9-in. gas searchlight. The car itself is equipped with electric lights, oversize tires, and other accessories.



Light Chemical Car Designed for Emergency Purposes in Suburban and Country Towns

PLAY STRING INSTRUMENTS BY PRESSING BUTTONS

An electrically operated tremolo attachment for banjos has recently been invented which enables a musician to play this and similar stringed instruments by pressing a series of push buttons instead of doing the customary pick work. The apparatus is mounted on a table and is supplied with a rack in which the banjo is held firmly. The tremolo device, which is partly incased in an aluminum housing, consists of a series of small shafts, at the end of each of which are fixed three

At the Left the Apparatus is Shown with a Banjo in Place Ready for Playing, While at the Right the Instrument is Removed, Displaying the Mechanism of the Device

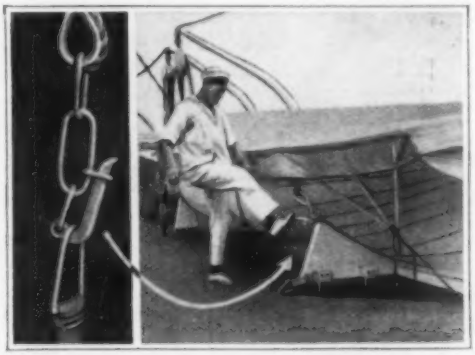
fiber picks. These rods, corresponding in number to the strings which they parallel, are actuated by a motor and controlled by buttons fitted in the front side of the case, which when pressed move the picks in contact with the strings, heavily or lightly as the player desires. The speed of the rods is regulated by a rheostat which allows a variation of from 600 to 2,000 picks a minute.

FIRST YEAR'S OPERATION OF PANAMA CANAL

During the first year of the commercial operation of the Panama Canal, which ended on August 14, 1915, a total of 1,317 seagoing vessels, in commercial or naval service and including yachts, passed through the canal. The gross tonnage of these vessels was 6,494,673. The eastbound and westbound traffic were practically equal, the eastbound traffic comprising 661 vessels with a gross tonnage of 3,227,757, and the westbound traffic comprising 656 vessels with a gross tonnage of 3,266,916. All tonnages were estimated on the basis of the Panama Canal measurement. The tolls earned during the year, including a little over $114,000 levied on United States government vessels but not collected, was $5,216,149.26.

DEVICE FREES LIFEBOATS IN RECORD TIME

To facilitate the work of releasing lifeboats from their leashes on a steamer, so that they may be swung out on their davits and lowered in the shortest possible time when an emergency arises, a new type of fastener has been invented. This device, which enables one man to free a score of boats in about a minute's time, has lately been adopted by an eastern company whose steamships ply between New York and Boston. It consists of a steel triangle and hook. The former is fixed to a rope fastened to the deck of the ship, while the latter is attached to the line that passes over the boat and is held in place by a link that fits over its upturned end. This ring protrudes over the rest of the fastening so that



A Sailor Runs along the Line of Lifeboats, Kicking Each of the Rings and Releasing the Boats

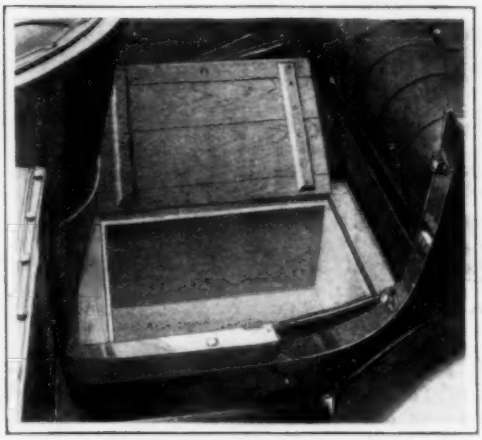
a slight upward stroke disengages it and releases the leash. A sailor is able to run along the line of boats, kicking each locking ring in turn and simultaneously freeing the various craft.

COMBINATION SCREWDRIVER AND HAMMER

A new tool designed for carpenters and other woodworkers, and particularly convenient when a screw is to be hammered into the wood far enough for the threads to catch, is a combination screwdriver and hammer just placed on the market. The hammer head is pivoted at the center to the handle end of the screwdriver, and when folded into line with the tool, it forms part of the handle. When turned at right angles, it serves either as a hammer head or as a means for applying a greatly increased leverage to the screwdriver.

ADEQUATE SPACE FOR BAGS SUPPLIED IN MOTOR CAR

Luggage compartments of sufficient capacity to accommodate four suitcases are provided beneath the tonneau



Each of the Compartments Is Large Enough to Receive Two Suitcases

floor of a western-built motor car. This facility, which is a very convenient one when touring is to be done, has only recently been introduced. The carrying space is divided into two separate holds, enabling access to be gained to either one of them without necessitating the occupants of the tonneau to leave the car. By furnishing the storage room, the need of strapping paraphernalia to the fenders and runboards of the machine is escaped, while the baggage is also protected from dust and rain.

PASSING BATTLESHIP FLEET THROUGH PANAMA CANAL

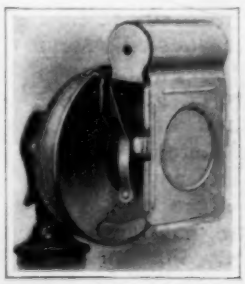
That the main battleship fleet of the United States Navy, comprising 21 vessels, could be passed through the Panama Canal in one day is the opinion of the commander of the fleet composed of the "Missouri," "Ohio," and "Wisconsin," which were the first of the big warships to go through the canal recently. At the Pedro Miguel and Miraflores locks the "Missouri" and "Ohio" were locked through side by side, one in each of the duplicate locks, with the "Wisconsin" occupying the lock with one of the other ships. By this method four battleships could have been put through as easily and in the same length of time. In the case of dreadnaughts only one ship could be placed in a lock at one time, but even ships of this size could be sent through in pairs.

PEAT USED IN MANUFACTURE OF GAS

Gas that is declared to be of excellent quality is being extracted from a mixture of coal and peat, at a municipal plant in Friesland, in the northern part of Holland. No attempt is made to use the peat alone, because of the excessive heating of the retorts by the steam that comes from the moisture in the peat. The retorts are filled with two parts in weight of coal to one part of peat. The peat is entirely consumed in the process so that there are no by-products as with coal. Since most of the coal used in Holland must now be imported from a great distance at heavy cost, the process is resulting in a great saving in the cost of gas, especially in Friesland, where peat is plentiful and can usually be dug in the vicinity of the gas works.

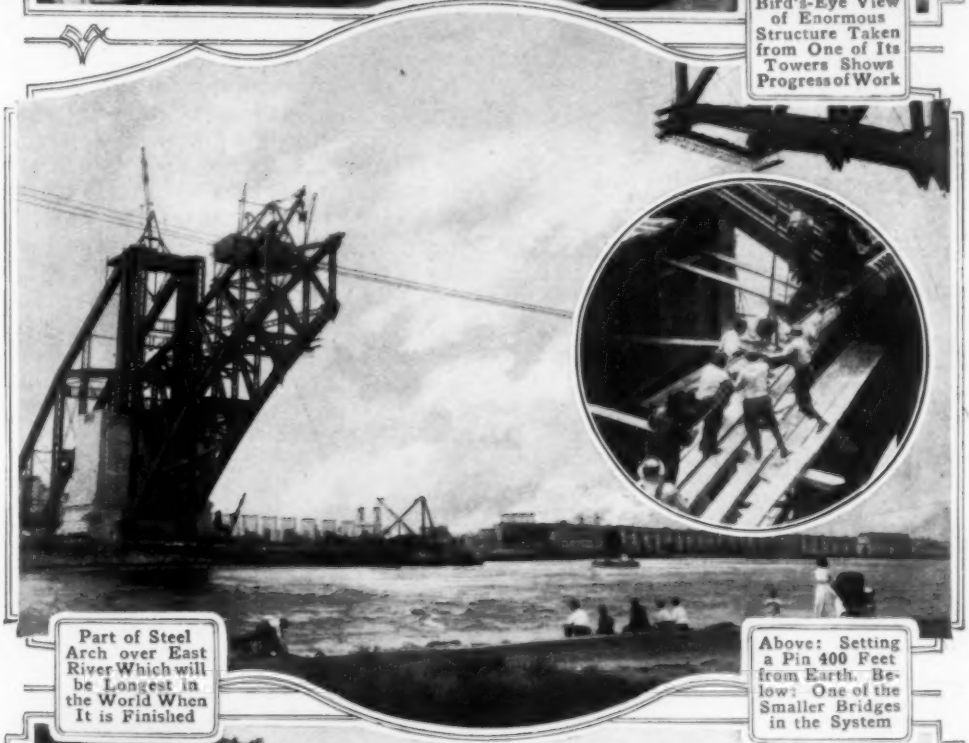
NOVEL SANITATION DEVICE FOR THE TELEPHONE

As a sanitary protector for a telephone transmitter an ingenious attachment which covers the mouthpiece of an instrument and prevents the accumulation of filth within it, has recently been brought out. The device is made of nickeled steel and consists of a compact case, at the top of which a small roll of thin paper is supported. A strip of the latter is held in place over the transmitter and may be changed whenever desired



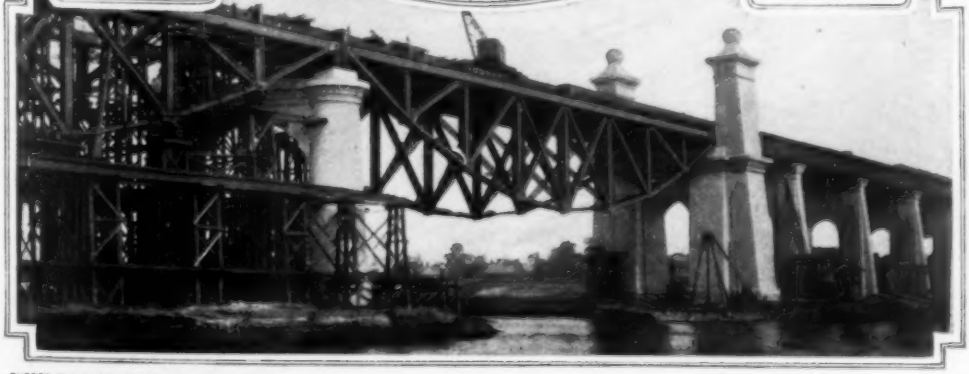
GREAT HELL GATE BRIDGE NEARS COMPLETION

Bird's-Eye View of Enormous Structure Taken from One of Its Towers Shows Progress of Work



Part of Steel Arch over East River Which will be Longest in the World When It is Finished

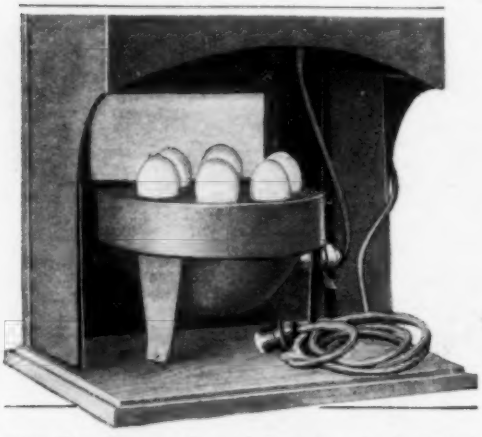
Above: Setting a Pin 400 Feet from Earth. Below: One of the Smaller Bridges in the System



PHOTOS COPYRIGHT, UNDERWOOD & UNDERWOOD

EGG-TESTING DEVICE MADE FOR LARGE CONSUMERS

For testing eggs in hotels, restaurants, and similar places, an electrically operated device is being made which

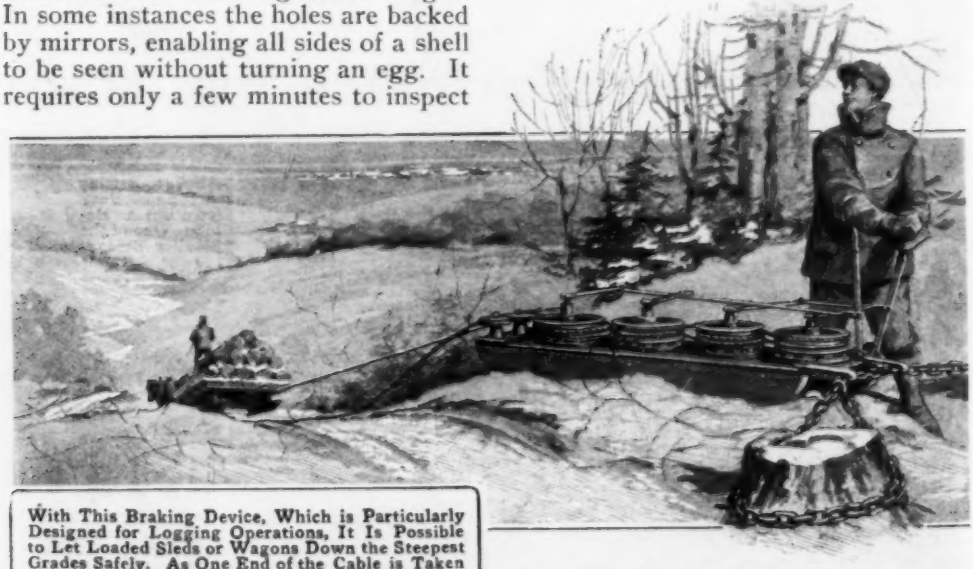


With This Tester a Case of Eggs may be Inspected and the Unfit Ones Separated from the Others Rapidly

enables the quality of such produce to be determined quickly. The tester is made in several sizes and styles, but the general principle is the same in each case. A circular receiver with felt-cushioned spaces for the eggs is mounted over a strong electric light. In some instances the holes are backed by mirrors, enabling all sides of a shell to be seen without turning an egg. It requires only a few minutes to inspect carefully the contents of a case. This permits the return of poor eggs and also insures against their being served to patrons.

BRAKING APPARATUS FOR LOGGING VEHICLES

Heavy loads may be safely let down the steepest grades by the use of a new braking device that is particularly designed for logging operations in hilly or mountainous country. This device consists of four sheaves mounted on a solid frame that is anchored to the top of the hill and is equipped with hardwood blocks for braking each of the sheaves. Around these sheaves runs a cable so arranged that while one end of the cable is being taken downhill the other is being drawn in. The braking blocks are controlled by two levers by which two or four of the sheaves may be braked, as may be necessary. The down-going wagon or sled is hitched to one end of the cable. On a winding road, roller posts are set at each curve. On reaching the bottom of the hill the driver unhooks the cable and notifies the man at the top by means of an electric bell. The device is then ready for instant use by the next wagon or sled.



With This Braking Device, Which is Particularly Designed for Logging Operations, It Is Possible to Let Loaded Sleds or Wagons Down the Steepest Grades Safely. As One End of the Cable is Taken Down the Hill by the Vehicle the Other End is Drawn to the Top in Readiness for the Next Load

MOTOR TRUCKS ARE BUILT IN IOWA PRISON

Following the abolition of the contract-labor system in the state penal institutions of Iowa, it devolved upon the prison authorities to direct the energies of the convicts more or less into new channels in order to keep them occupied. While a readjustment was being made to suit the changed conditions, a number of prisoners at the Fort Madison penitentiary who are skilled mechanics, were put to work making a motor truck. This was done principally as an experiment. The result, however, was that the men turned out a machine sufficiently good to cause an order to be given for the manufacture of 14 similar ones to be used at the different state institutions. It is now believed by the warden that it is feasible to establish a motor-truck plant as a part of the prison factory and keep a certain number of convicts engaged in building machines, which it is assumed could be disposed of readily.

Motor Truck Built by Convicts in the Fort Madison, Iowa, Penitentiary as an Experiment

EXPRESS SERVICE IS TRIED ON SURFACE LINES

In an attempt to increase the traffic capacity and lessen the schedule running time on surface-traction lines at Chicago, a "skip-stop" operating system has been inaugurated experimentally on several routes. The plan abolishes the custom of stopping cars at all street intersections, in a specific zone, and designates regular points at which passengers are to be received and discharged. The average distance between these points is 687 ft., while in the past the average has been 407 ft. Thus more than a third of the stops are eliminated and the maintenance of a much faster schedule made possible. If the test proves successful, it is intended to make the plan general.

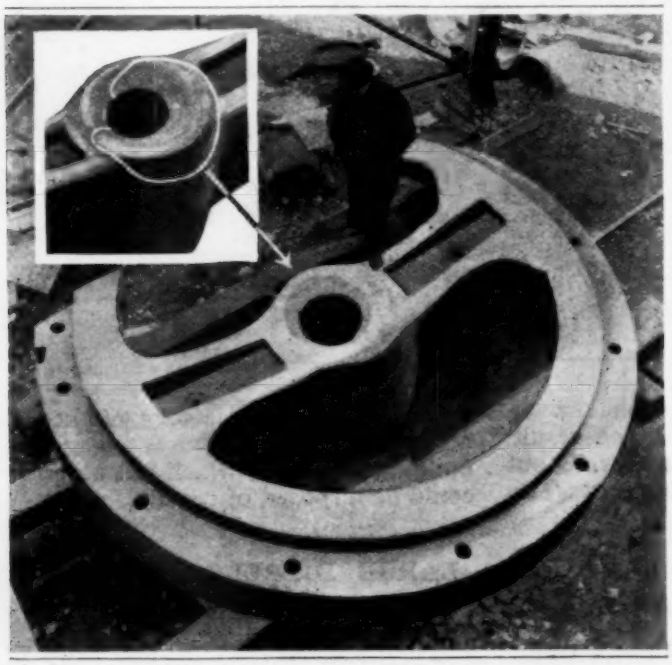
LARGE DIPPERS EMPLOYED IN WATERING LAWN

Tin pans secured to the ends of poles, forming long-handled dippers, are used in watering the grass-covered terraces along the banks of a river at San Antonio, Texas. The stream meets the edge of the grass, making it easy for a keeper to walk along the shore line and dish up plenty of water.

With Dippers of This Kind the Terrace is Watered without the Use of a Hose

ENORMOUS WELD MADE WITH OXYACETYLENE FLAME

In repairing the cracked and broken hub of the spider for a gyratory stone crusher, one of the biggest jobs of oxyacetylene welding ever attempted was recently carried out successfully in Chicago. The section of the spider that included the hub, shown in the illustration, weighed 60,000 lb., while with the segment not shown the spider weighed 80,000 lb. After the crack and break in the hub had been chipped out it was necessary to weld in more than 900 lb. of metal. The actual welding required more than 60 hours of continuous work, the fractured hub being buried in a charcoal fire during the process to prevent local expansion or contraction.



In Repairing the Hub of This 30-Ton Spider, More than 900 Pounds of Metal was Welded into Place with the Oxyacetylene Flame

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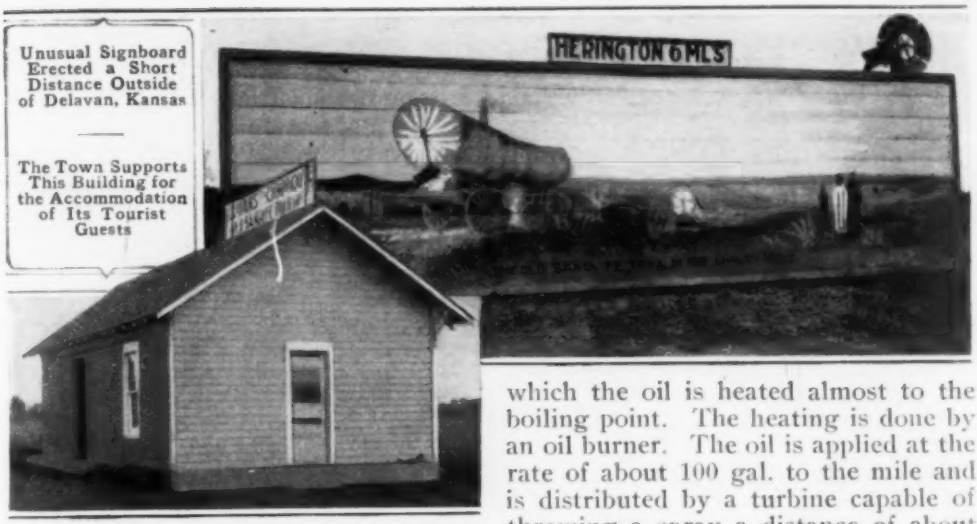
¶A journal devoted to the interests of publishers estimates that the number of persons in the United States who buy books is about 16,000,000. Of these, 500,000 are classed as regular book buyers.

STRENGTH AND LIGHTNESS FOUND IN NEW ALLOY

Bronze, made by a secret process, is being used in manufacturing die-cast machine parts which are claimed to be more durable than steel. The new alloy, which has a copper content varying from 75 to 97 per cent, is not in combination with tin, zinc, lead, or phosphorus. It has a tensile strength as great as 100,000 lb. to the square inch, a specific gravity of 7.35, is an electrical conductor and nonmagnetic. It can be either cast in sand or die-cast, eliminating the necessity of much machine and handwork in finishing. The most peculiar characteristic claimed for it is that it cannot be softened by any known annealing method. Castings made of the alloy are said to be twice as strong as steel and will not rust or corrode, or be affected by hydrochloric or sulphuric acids. Small chisels made of the alloy for advertising purposes are capable of cutting iron or soft steel. Lightness and strength are two of the outstanding points advanced in favor of the bronze, which may be machined or forged readily.

KANSAS TOWN BUILDS HOUSE FOR TOURING MOTORISTS

Motorists who tour the old Santa Fe trail through Kansas are given a real example of hospitality when they reach the little town of Delavan, where a municipal "camp house" has been erected for their reception. This is a neat, white frame structure which provides separate spaces for two motor cars and accommodations for several



Unusual Signboard Erected a Short Distance Outside of Delavan, Kansas

The Town Supports This Building for the Accommodation of Its Tourist Guests

guests. The living quarters are plainly, but comfortably, furnished and equipped with cooking utensils, a stove, toilet articles, road maps, a telephone, and other little things convenient for travelers. Daily newspapers are kept on file with magazines and a few books. The building offers a clean place to spend the night, or obtain shelter during a storm. The garages also give chauffeurs an opportunity to tune the engines of their cars and make minor repairs during the stop. Two miles west of the place is a large signboard which points the way to Herington, the next town, and bears a picture of the "Old Santa Fe Trail in the Forties."

SPRINKLING COUNTRY ROADS WITH OIL

In some sections of the country oil is being extensively used in place of water for sprinkling country roads. It has been found that the oil not only lays the dust as effectively as water and as cheaply, but that after a dozen applications it covers a macadam road with an asphalt surface that is dustless and practically permanent. A typical sprinkler, used in California, consists of a truck on which is carried a tank for the oil supply, with a smaller tank, carried on the rear of the truck, in which the oil is heated almost to the boiling point. The heating is done by an oil burner. The oil is applied at the rate of about 100 gal. to the mile and is distributed by a turbine capable of throwing a spray a distance of about 18 ft. The power for driving the turbine is obtained through a roller that engages one of the wheels of the truck,

Machine Used in California for Sprinkling Country Roads with Oil

and the spray is regulated by a valve that controls the admission of oil to a chamber in the center of the turbine.

¶At a recent national convention of jewelers a publicity campaign was started for the purpose of inducing the people of the United States to wear jewelry by seasons.

BUSY STEAM-RAILWAY LINE ELECTRIFIED

The electrification of 20 miles of heavy-traffic railway line is now being completed between Paoli, Pa., and the Broad Street station of the Pennsylvania Railroad in Philadelphia. In spite of the fact that over one section of this line no less than 2,295 train movements occur daily, this work has been accomplished without accident of any kind and without interference with traffic. Current is transmitted to the cars by means of overhead wires, the type of construction being what is known as the "catenary" system. A heavy wire, which necessarily has some sag in it, was first stretched between supports, and from this the trolley wire is suspended by vertical wires of varying length, so that it hangs level and straight. This construction is used as a means of keeping the sag out of the trolley wire and thus preventing sparking at the supporting points when a train is running at high speed. The work was done at a cost of about $4,000,000.

¶ The severe and prolonged headaches caused by inhaling the fumes of nitroglycerin, or by handling dynamite with bare hands in hot weather, are due to the fact that nitroglycerin is a powerful heart stimulant.

BLOWING CONCRETE INSTEAD OF POURING IT

By H. B. KIRKLAND

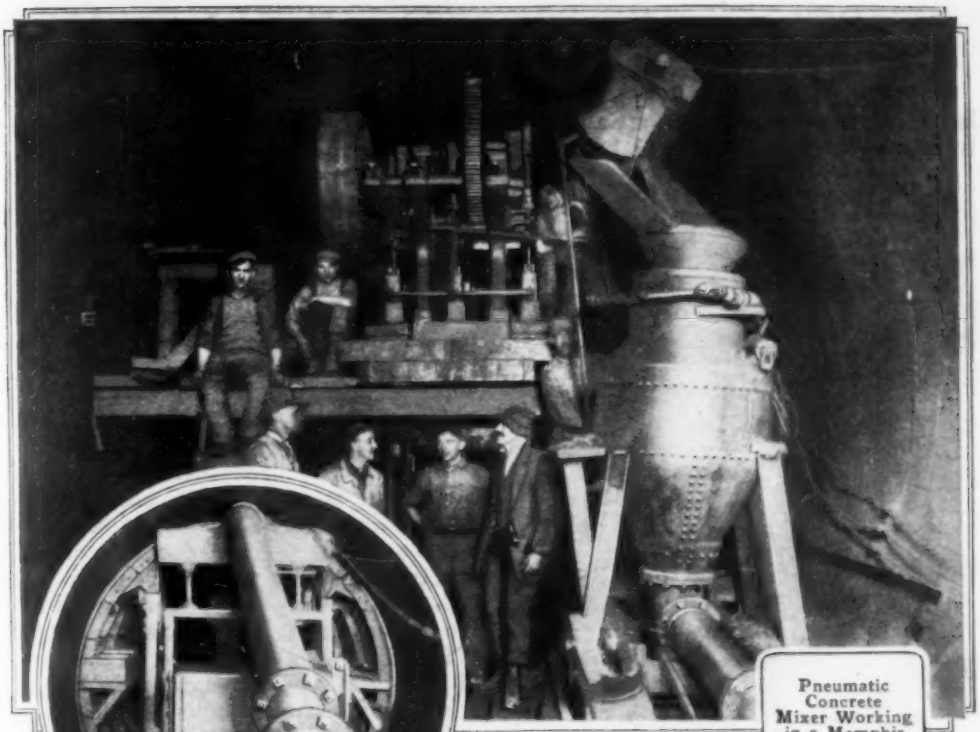
THE art of making masonry of a wet mixture of cement and stone poured into molds has developed many methods and machines. The latest of these is that of blowing concrete through a steel pipe from a central mixing plant to the forms, or molds. This method is particularly advantageous for building the walls and arched roofs of railroad tunnels and other smaller tunnels. Although the government patent has only recently been issued, the method has been adopted on practically all tunnel work in the United States, and is also finding a place in the construction of other large concrete work.

Besides the actual conveying of the concrete through the steel pipe, it is also mixed by the blowing process. The cement, sand, and stone are simply dumped into the machine, which is then sealed by an air-tight door at the top, whereupon the materials are mixed and discharged by passing air at high pressure through the machine and out through the pipe at the bottom. The materials travel through the pipe like dust in a hurricane, and the speed is estimated to be about 150 miles per hour. The pressure required to discharge each batch is equivalent to about three tons.

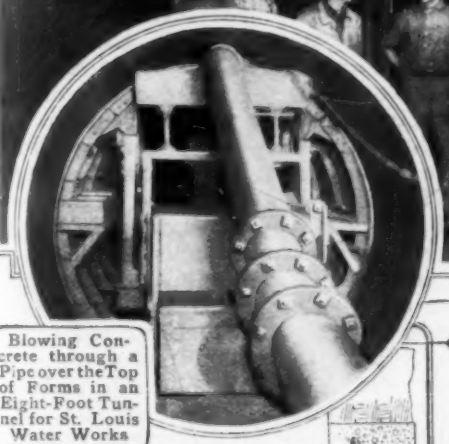
Tunnels are lined by blowing the concrete into the molds, at the top, with great velocity and allowing the material to flow over into the side walls until the whole space to the top of the arch is filled solidly. After the concrete has become set sufficiently hard to remove the molds, they are drawn forward on wheels to the next position, and the operation is repeated.

Before this method was adopted for tunnel work, 40 or 50 men were required to place the concrete. The concrete was mixed in a mechanical mixer and discharged in the cars, which were pulled by small locomotives to the forms in the tunnel; the cars were then elevated to a platform and dumped onto a shoveling board, and from here the concrete was shoveled into the forms. The method was slow and expensive.

With the pneumatic method, a single steel pipe takes the place of expensive equipment and of two-thirds the labor formerly used. The average gang of men required for this method is about ten and a great amount of the danger of tunnel work is obviated.



Pneumatic Concrete Mixer Working in a Memphis Tunnel



Blowing Concrete through a Pipe over the Top of Forms in an Eight-Foot Tunnel for St. Louis Water Works

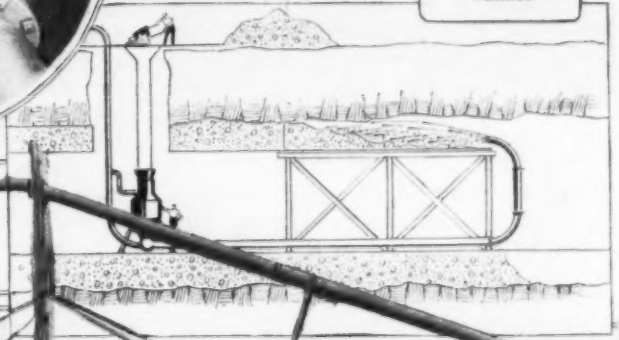
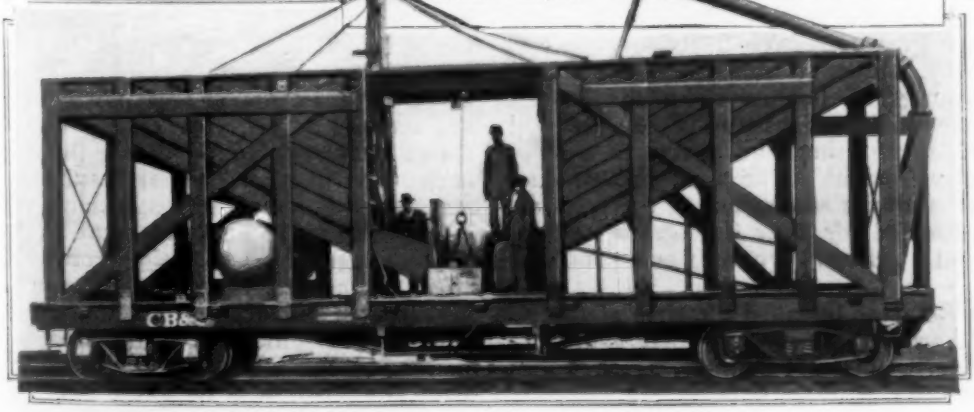


Diagram Shows How the Concrete Blowing Apparatus is Installed and Operated in a Tunnel.
Lower View: Portable Plant Used by a Railroad System for Its Tunnels



GRAFTING NEW ROOTS ON AN OLD TREE

Supplying new roots for an old tree is the feat accomplished by a California fruit grower whose orchard had been

Healthy Shoots Planted around a Diseased Tree and Grafted to the Trunk to Serve as New Roots

attacked by pear blight. To stop this disease it is often necessary to cut away affected portions of the tree and roots, and a tree is sometimes killed by the means used to cure it. To save a pear tree that had been deprived of the greater portion of its roots in this way, the plan was tried of planting young and healthy shoots all around the trunk and grafting these to the old tree after they had grown to a sufficient height. The plan proved successful, the sustenance of the tree was provided for after the severe cutting, and a valuable producer was saved.

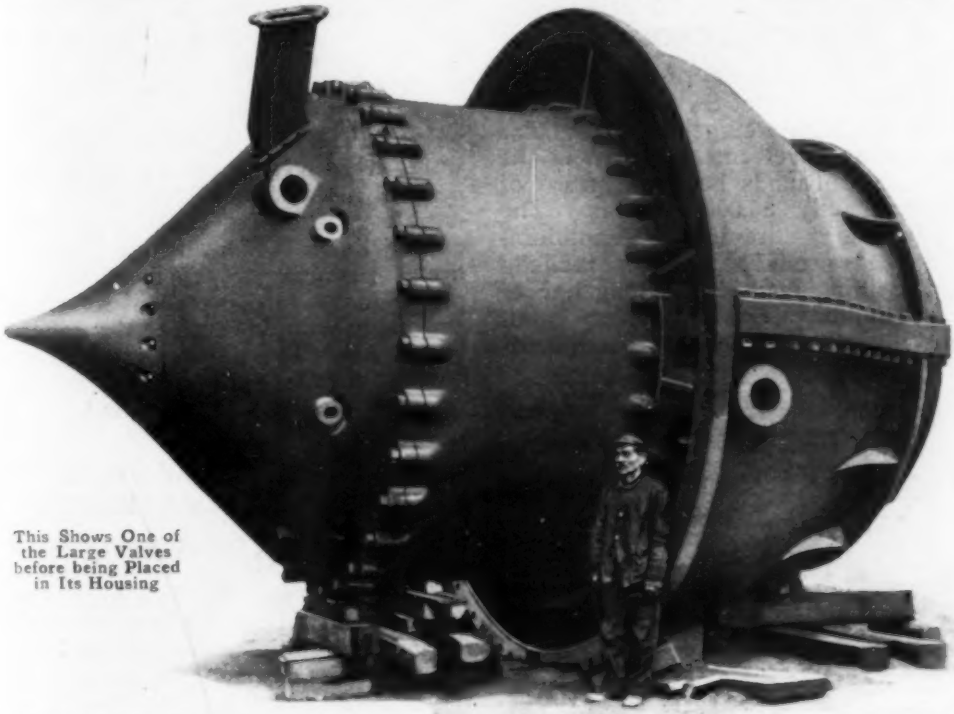
¶ Belgians between the ages of 16 and 40 are forbidden, by the German governor-general of Belgium, to leave that country without written permission.

WHY MERCURY-VAPOR LIGHT IS EASY ON THE EYE

One of the greatest advantages in the mercury-vapor arc is the color of its light, experience having shown that less eye strain is caused by light produced in this way than by any other artificial means of illumination. This condition is easily explained on scientific grounds. The mercury-vapor arc is produced by a device consisting essentially of a vacuum tube in which mercury is vaporized sufficiently to serve as a conductor for an electrical current passing from one end of the tube to the other. The result is an electric arc of great brilliancy. Unlike the light given off by a solid conductor, that given off by a gas contains only a few of the colors of the spectrum, nearly 60 per cent of the light emitted by the mercury-vapor arc being green or yellowish green. White light is a composite of the rays of all colors, and these different colors are brought to a focus at different points in the eye. The red elements, for example, come to a focus farther from the lens than the blue and violet rays, while the yellow and green rays come to a focus at a point intermediate between these extremes. As it cannot adjust itself for all the colors at once, the eye automatically focuses for the green rays, letting the red focus behind the retina and the blue and violet in front of it. In addition to this, the retina is more sensitive to the green, since this color has the middle position in the range of colors which the eye can distinguish. Green and yellowish green are therefore the colors that cause the least eye strain. Owing to the sensitiveness of the eye to these colors only about one-half the illumination for obtaining equal results is required with a mercury-vapor lamp as is required with an incandescent lamp of the tungsten type. Aside from the effect on the eye, the economy resulting from transforming current into light of such efficiency is therefore a matter of importance, especially where much illumination is required.

TWELVE-FOOT VALVES BUILT FOR POWER STATION

Water valves 12 ft. in diameter and so designed that they are capable of closing automatically in the event of a break occurring in the pipe line are being installed at a Utah hydroelectric plant. They are made alike, each with a bulblike shell, or housing, which in reality is an enlarged section of the pipe. Each valve consists essentially of two large cones, one of which acts as a sliding plunger and regulates the flow. The nose of this and the form of its companion piece are both shaped to guide the water through the gate without materially lessening its pressure. The operating mechanism is arranged so that the pressure of the water in the conduit is utilized in opening and closing the valve, in the former instance forcing the plunger back so that it nests inside of the larger section and allows the water to pass freely.



This Shows One of the Large Valves before being Placed in Its Housing

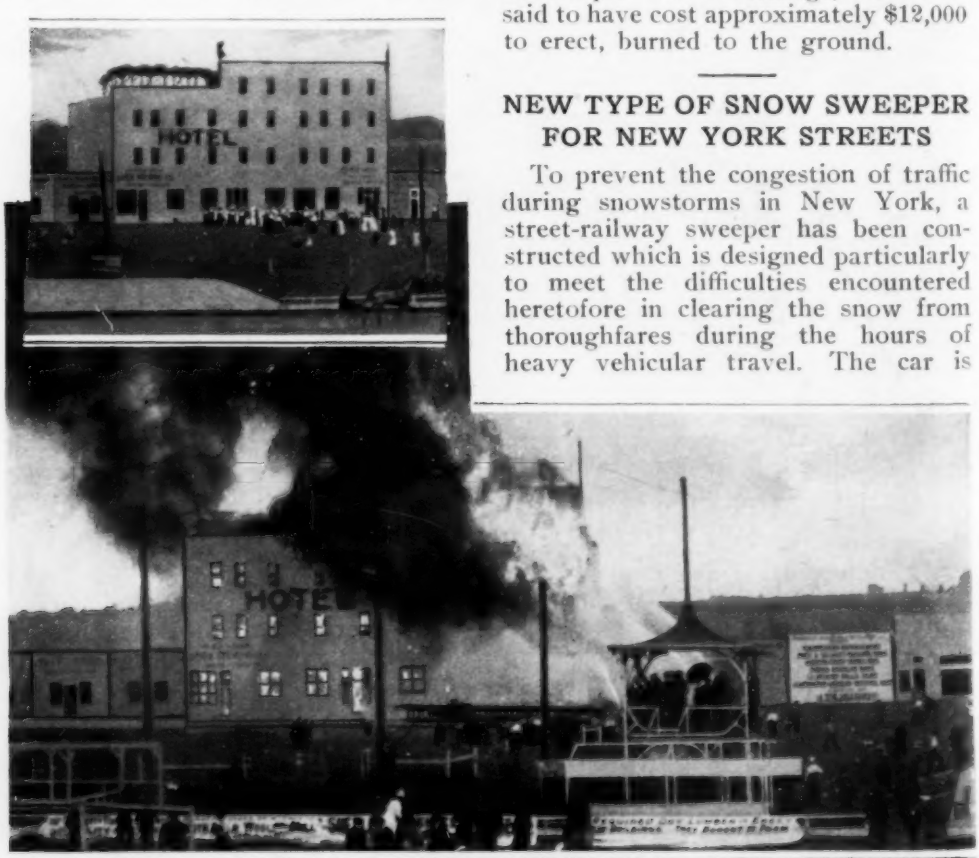
WOMEN TO PROMOTE NATIONAL PREPAREDNESS

The enlistment of millions of American women in a nation-wide organization to promote national preparedness is the purpose of a society recently formed in New York. Immediate action by Congress is to be urged by this society, but other work of as great importance is to be undertaken on a big scale, and has in fact already been begun. Lists are being prepared of women who are willing to offer their summer homes for use as hospitals in case of war, and specimen kits for the regular and volunteer army, as well as kits for hospital purposes and for convalescents, have been made up. The compilation of lists of sewing clubs which may be called on for the preparation of garments needed in the field is also being made. The society has undertaken to keep a register of nurses and others who would volunteer their services in connection with war relief

in this country, and of possible contributors of materials and funds, the idea being to have all relief work thoroughly and permanently organized and ready for quick action in case of emergency.

MODEL VILLAGE IS BURNED TO AMUSE CROWDS

About the middle of summer the fire departments of St. Paul and Minneapolis, Minn., staged a spectacular as well as novel entertainment at the state fair grounds before a crowd of approximately 30,000 persons. The event was a fire-fighting exhibition which was produced in a most realistic and thrilling manner. A long line of frame buildings, one a four-story hotel, and all of them typical small-town structures, had previously been erected before a grand stand. Nearly a hundred men and women were placed in the "guest rooms" and roof garden of the hostelry before the buildings were set afire. As smoke commenced to roll out of the windows and streaks of flame shot from the roof of the hotel, policemen patrolling the "street" turned in an alarm summoning the awaiting fire departments. The rest of the exhibition was fraught with real work. While a half dozen streams of water were being played on the roaring blaze, the "rescue" work was undertaken. Some of the players were carried down ladders on the backs of firemen, others jumped from the upper windows into nets held for them, and many were lowered to the ground with ropes. The buildings, which are said to have cost approximately $12,000 to erect, burned to the ground.

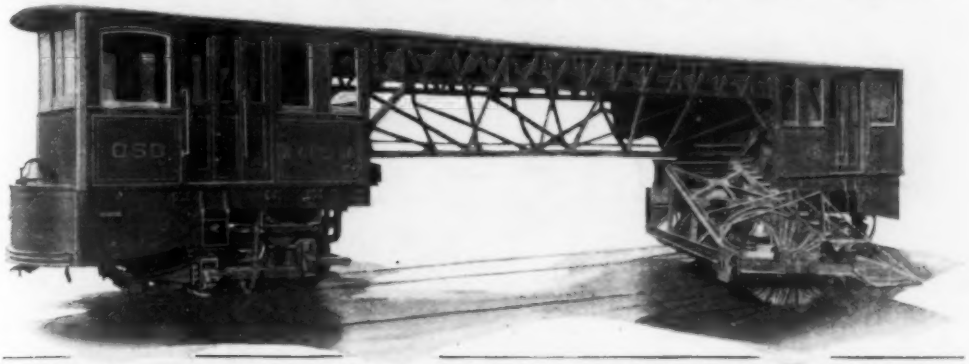


Above: Section of the Buildings of the Model Town Before the Fire was Started. Below: The Buildings in Flames and the Fire Fighters Carrying Out Their "Rescue" Work

NEW TYPE OF SNOW SWEEPER FOR NEW YORK STREETS

To prevent the congestion of traffic during snowstorms in New York, a street-railway sweeper has been constructed which is designed particularly to meet the difficulties encountered heretofore in clearing the snow from thoroughfares during the hours of heavy vehicular travel. The car is

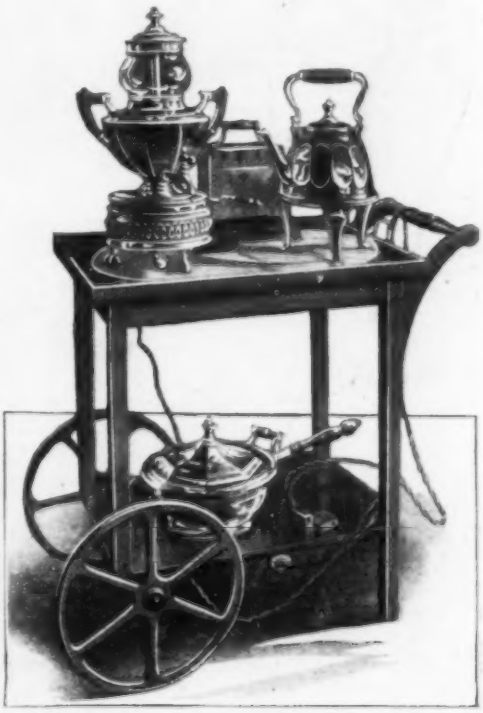
provided with a large, outboard rotary brush which is so mounted that it may be moved freely back on the tracks when vehicles are encountered. It is also arranged so that it may be swung from one side of the street to the other at any angle, when it is desired to reverse the direction of the car. It is capable of sweeping a path 12 ft. in width, or narrower, while the car is going at a normal speed, without hindering the progress of passenger cars behind. A fender is provided in front of the broom. This equipment is expected to expedite greatly the work of the street department.



This Snow Sweeper is Adapted Particularly for Clearing Streets on Which There Is Heavy Vehicular Traffic

SERVING TABLE IS WIRED FOR ELECTRIC DISHES

As a convenient appointment for a breakfast room, a tea wagon, wired and fitted with connecting sockets for the accommodation of a coffee percolator, a toaster, and a chafing dish, has been introduced. Except for the wiring it is not different from an ordinary serving cart. In homes where electric table appliances are utilized freely, it makes a very attractive and serviceable accessory, for it may be used for almost any informal occasion and in any room, or sun porch, where a lighting socket is available. By having the various electric appliances on a tea wagon the work of both setting and clearing a table is simplified, while the latter is also left unincumbered by serving and warming dishes during a meal.



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An Electric Serving Table Is Very Convenient When Electric Table Appliances are Used

¶"California's Magazine" is a new quarterly journal made up of information relating to the industrial, agricultural, commercial, and social activities of the state of California.

PICTURESQUE CUSTOMS OF ROMANTIC PEOPLES

Typical Wine Caravan in Trans-Caucasia: The Vintage is Contained in Oxen Skins Which are Secured to a Rough Cart Such as is Shown Above. This Driver was Seen in the City of Tiflis

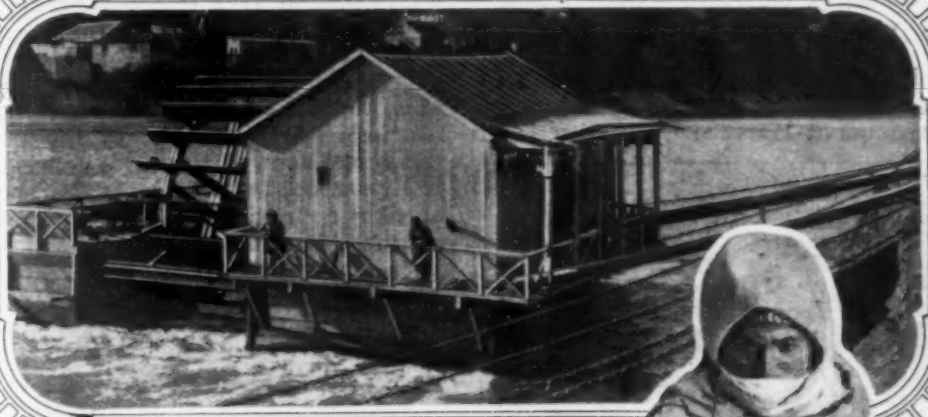
Armenian Patrolman on the Lookout for Robbers, Many Bands of Which Hide in the Mountains

Firewood Packed on Backs of Donkeys is Sold in the Streets

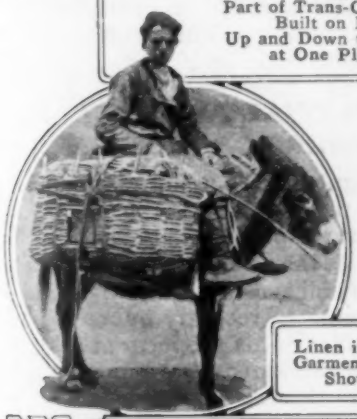
Water Seller in One of the Villages: Water is Carried in Earthen Urns Fitted in a Heavy Framework Packed on the Back of a Donkey. It is Only in Certain Localities That These Peddlers are to be Found

PHOTOS BY HENRY RUSCHKIN

OF THE CAUCASUS SHOWN IN CAMERA GLIMPSES



Mill on the River Kur in the Southeastern Part of Trans-Caucasia: This Structure is Built on Pontoons and Worked Up and Down the Stream, Grinding First at One Place and Then Another



Bird Dealer, of Which there are Many: The Birds are Carried in Large Baskets Divided into Compartments and Fastened to the Sides of an Ass. With This Outfit the Young Armenian Lad Travels from Village to Village Buying and Selling

Linen is Much Used for Summer Garments throughout Russia. This Shows how Flax is Woven

Farrier Working in the Open: It may be Seen that Greater Precaution is Taken in Shoeing Some of the Native Beasts of Burden than Is Common in This Country

QUAINT SUNDIAL ERECTED ON HARVARD BUILDING

Near the top of the south wall of Smith Hall, one of the new dormitory buildings at Harvard University, is an

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Sundial of Pleasing Appearance Built in Dormitory Wall at Harvard

artistic sundial. Its design is an expression of simplicity and taste. The dial itself is square in shape and marked with Roman numerals which start with the figure "VIII" in the upper left-hand corner and proceed in regular order in a "U" fashion around to the opposite corner, where the figure "VII" appears. At the top of the face is the single word, "Veritas," the Harvard motto. The half hours are indicated by separating marks between the hour characters.

STABILITY TEST IS GIVEN OLD LAKE STEAMER

Following the "Eastland" tragedy at Chicago, many of the excursion boats in the lake service were subjected to stability tests. The first of these was the "Christopher Columbus," an old, ungainly whaleback which plies between Chicago and Milwaukee. This vessel successfully underwent what was regarded as a severe experiment in demonstrating its seaworthiness.

The federal inspectors allow this ship to carry a maximum of 3,736 persons, including the crew, under certain restrictions. When put to the test, the vessel showed that in a comparatively smooth sea it is capable of supporting approximately 5,000 persons on one side of its center line without capsizing.

With a crew of 250 men and 50 officials and guests aboard, some 7,500 bags of sand, each weighing about 100 lb., were piled along the starboard side of the three passenger decks. At the time this was done the ship was practically stationary and its water-ballast tanks were empty. The steamer listed about 12 degrees.

SUBSTANTIAL AND ARTISTIC MARKER FOR HIGHWAY

Few country-wide undertakings have met with more genuine coöperation on the part of the public than has the construction of the Lincoln Highway. As a single evidence of this is a marker that was erected recently by an Iowan on one corner of his property at a junction of the national artery and a county road near Boone. It is a concrete structure several feet in height which identifies the intersecting roads for motorists and shows the respective

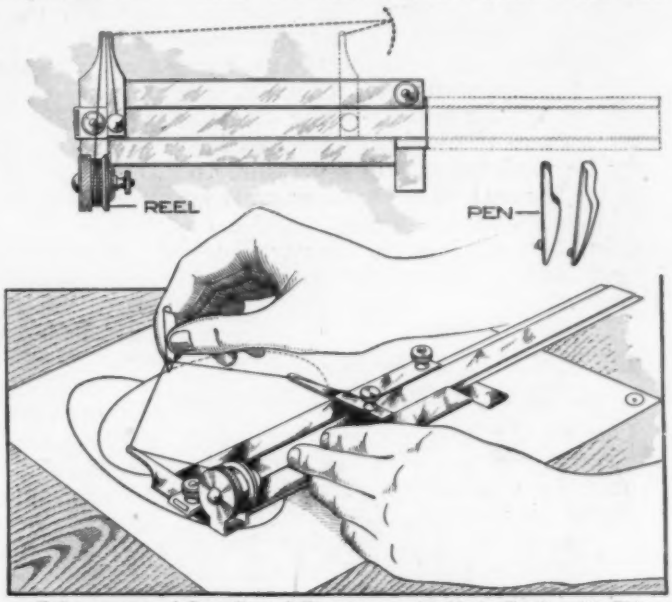
The Concrete Marker Identifies the Intersecting Routes and Stands on a Corner of the Builder's Property

routes to Boone and Des Moines. On one surface it bears the date of its erection and the initials of its builder. It is sufficiently heavy in construction to withstand years of weathering.

INSTRUMENT FOR REDRAWING GEOMETRIC FIGURES

Designed especially for assisting students of mathematics in the study of the conic sections, a simple, moderately priced instrument is made which may be used to facilitate the work of reproducing and enlarging complicated figures presented in textbooks. Drawings of this kind, encountered in geometry of position and similar subjects, are often small, which makes their resketching in large proportions difficult for the novice. This instrument makes the task of plotting and sketching ellipses an easy operation and allows a beginner to produce neat, quick work.

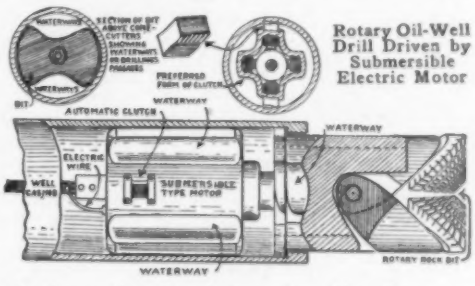
It is provided with two arms, one of which is movable, and both of which are threaded with a fine cord, a reserve of which is held on a reel. In using the instrument, it is placed with its arms extending forward and its points adjusted so as to span the foci of the major axis of the proposed ellipse. The amount of tape needed is determined by the length of the greater axis. The former is made taut around a pencil, or pen, point placed at one end of the major axis. A line is then drawn with the marker to pass through one end of the minor and the opposite end of the major. By then reversing the position of the instrument the ellipse may be completed.



Enlargements of Complicated Figures may be Made Easily with This Instrument. The Special Pen Point Provided with the Instrument may be Used in an Ordinary Holder if More Convenient

ROTARY OIL-WELL DRILL OF A NEW TYPE

A submersible electric motor that grips the side of the casing, but can easily be released for raising or lowering, forms one of the principal features of a new type of rotary oil-well drill that has recently been developed. When in operation the motor is held stationary at the bottom of the casing by automatic clutches and drives the drill bit through a short shaft. A 10-hp. induction motor is used. The bit is made up of two cones, each of which has a plurality of serrated cutting edges, and is of an expansible type so that it drills a hole large enough for the casing to follow. Both the motor and bit are provided with waterways, and through these the drillings, finely pulverized by the bit, float to the surface of the water, where they

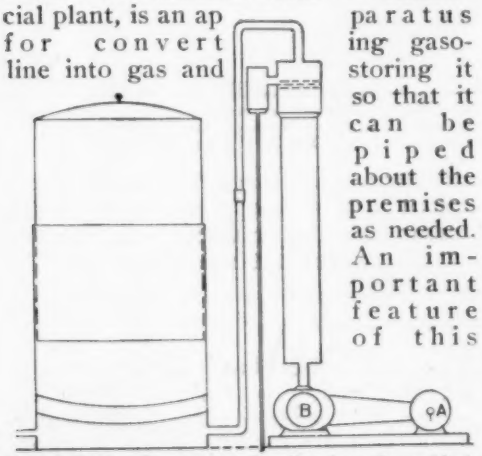


Rotary Oil-Well Drill Driven by Submersible Electric Motor

are removed by a bailer. Power is supplied to the motor through electric wires that are inclosed in the hoisting cable and are thoroughly protected from the water. The clutches that hold the motor to the casing are released simply by reversing the direction of rotation, and the motor and bit can then be easily raised to the surface. With this apparatus the power is the same no matter how deep the drilling may go and the weight of the casing may be used for applying pressure to the bit if required. The apparatus is rapid in its action, being capable of drilling 3 in. a minute in compact limestone, and 2 in. a minute in red granite.

GAS PLANT DESIGNED FOR THE COUNTRY HOME

One of the latest conveniences for the country home, where as a rule gas cannot be obtained from a commercial plant, is an apparatus for converting gasoline into gas and storing it so that it can be piped about the premises as needed. An important feature of this apparatus is that it does away with the necessity for having the liquid gasoline near a flame. The only power needed is a small motor for running the blower that forces the air through the generator and into the storage tank. The generator consists simply of a vertical cylinder with an enlarged top in which are baffle plates. Adjacent to the cylinder is a carburetor to which the liquid gasoline is fed either by gravity or by a force pump. The carburetor discharges the gasoline on the baffle plates in exactly the right quantities to form the required mixture of air and gasoline, which permanently retains the form of a vapor. From the generator the mixture of air and gasoline passes through a pipe to the storage tank. The top of this tank consists of a bell that rises and falls with the varying content of gas and is equipped with a water seal exactly like that of one of the big tanks used by commercial companies. When power is furnished by an electric motor or water wheel, the plant can easily be rigged for automatic operation by the bell. With this arrangement, when the tank has been pumped full of gas, the power is automatically shut off, and the bell lowers gradually as the gas is used. When the supply is almost exhausted the apparatus is again started automatically and another installment of gas is made. The gas is said to be practically odorless and safe, there being no danger to animal or plant life when a burner is left open by mistake. It is claimed that the cost of the gas is less than half that of producer gas.

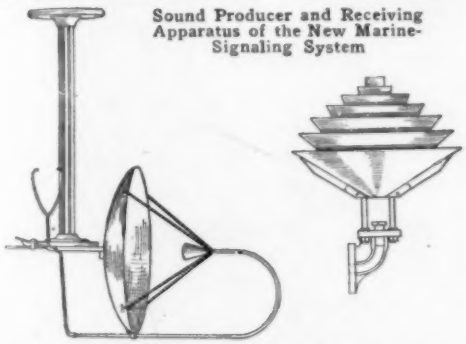


Apparatus for Converting Gasoline into Gas; Air is Forced into the Upright Cylinder by the Blower B, Which is Driven by the Motor A; the Air and Gasoline, After being Mixed in the Enlarged Upper End of the Cylinder, Pass through the Pipe into the Storage Tank at the Left

COURSES OF SHIPS IN FOG INDICATED BY SIGNAL

There are few things more trying to a mariner than the uncertainty which accompanies the sounding of a foghorn, for while he knows that another ship or dangerous water is near, it is very difficult for him to determine with any degree of certainty the direction of the sound source, because of puzzling echoes. To overcome this and lessen the danger of vessels colliding under such conditions, a new signaling apparatus has recently been invented. It consists partly of a steam-operated sounder making a loud hissing noise which is echoed very faintly, if at all. A special receiving instrument is used to detect the sound and indicate the direction of its source. This con-

sists of a concave reflector, at the focus point of which is a receiver provided with ear tubes. The device is placed on deck and so mounted that it may be turned to the various points of the compass. Unless it is pointed almost directly at the source, however, the signal cannot be heard. The hissing blast is blown following the use of the ordinary whistle. When the whistle is heard the operator of the receiving instrument on some adjacent ship turns the reflector until the hissing sound is audible to him. A pointer arm which moves over a compass dial and is actuated by the turning of the reflector then shows almost exactly the direction from which the signal has come. Repeated observations of this kind will

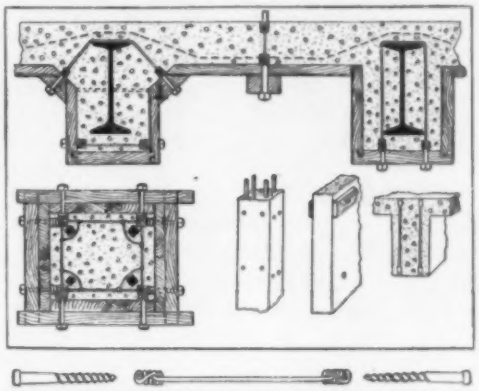


Sound Producer and Receiving Apparatus of the New Marine-Signaling System

show whether the signaling ship is stationary, or what general course it is pursuing.

NEW FORM HOLDER FOR CONCRETE WORK

A new form holder for concrete construction consists simply of a specially made rod that is left permanently in the wall after the work is finished, and not only serves as reinforcing but provides sockets by which attachments or future construction may be connected, if desired. It can be used to bind the two sides of a wall form together, or can be placed with one end imbedded in the concrete, to suit the conditions. Each end of the rod is closely coiled so that the coils serve as threads for specially made bolts. The rod is placed so that the end of the coil comes flush with the surface of the concrete or a little below it, and the form is secured to the rod by means of the bolt. After the concrete is placed, the form is removed by unscrewing the

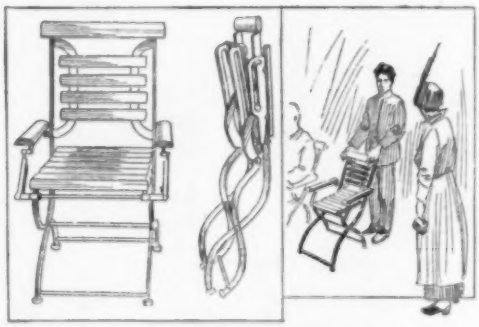


The Rod Not Only Serves as Reinforcing After the Concreting is Completed but Provides Sockets with Which Attachments are Easily Made

bolt, and the coil is pointed over, if it is not to be used as a connection. The rod serves as a spreader as well as a tie.

NEW THEATER CHAIR WITH FOLDING ARMS

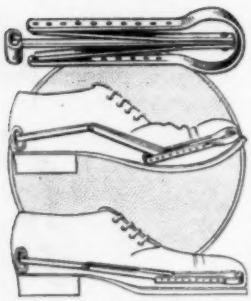
A new type of chair designed for use in theaters, and other public places, is so made that when not in use both the arms and seat fold up against the back and are out of the way. This chair is intended as either a fixed or portable seat. It is equipped with rubber floor



In This Theater Chair Both the Seat and Arms Fold Up against the Back

tips which are attached to the iron feet by screws. With the tips removed the screw holes are used in attaching the chair rigidly to the floor.

NOVEL AND PRACTICAL THINGS FOR THE HOME



Folding Shoe-Tree for Travelers

ESPECIALLY convenient for travelers is a folding tree that may be adjusted to fit any size or style of shoe. It is made compactly of metal in three sections. These nest together when the device is not in use, allowing it to be carried in a suitcase or bag, taking up but little space.

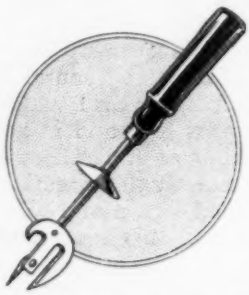
Dust-Collecting Attachment for Broom

As an attachment for an ordinary broom, an ingenious bellows device has been invented which is intended to collect the dust when sweeping is done. A trap placed on the suction apparatus receives the fine particles of dirt as they are collected before the broom. A flexible connection between the handle and the broom provides for the operation of the bellows.

Built-In Garbage Receptacle

One of the latest step-saving conveniences for the kitchen is a built-in garbage receptacle. This has a steel body which contains a garbage can. It is set in an outside wall so that access to it is given both from the inside and exterior of the house. On the outside is a hinged door that enables the removal of the receiver by a collector.

Several practical functions are performed by a can opener lately devised. It is designed to cut the tops of round, oval, and square cans; remove milk-bottle caps, lift the metal tops sealing bottled goods, and do other similar things. It is provided with a disk knife which cuts a circular hole.

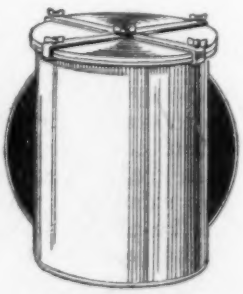


General-Utility Can Opener

Incorporated in the handle of a folding umbrella, which will fit into a suitcase, is a small electric flash light. The battery is contained in the stock, entirely out of sight but readily accessible. When it is raining it may be used to illuminate a sidewalk, while at other times it may be employed in the same capacity as a pocket lamp.

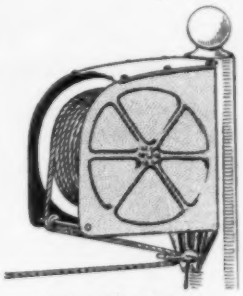
Flash Light Fixed in Umbrella Handle

For hermetically sealing culinary vessels to permit food being cooked in its own moisture, a specially designed top has been invented for earthen jars and metal cans. The cover is fitted with crossed arms which grip the rim of a receptacle. The cover may be clamped in place tightly, so that the utensil to which it is applied is made air-tight, by the use of thumbscrews.



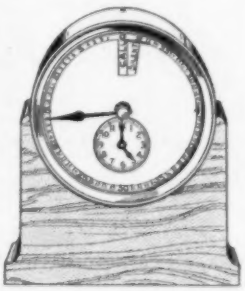
Air-Tight Cover for Cooking Utensils

Fixed in a weather-proof case, a clothesline reel is made which protects a rope from rotting, or being soiled by exposure, and also lessens the trouble of removing and subsequently re-stretching it. The device is attached to a post or building. When a line is wanted, the desired amount of rope is drawn out and one end fastened in place. The reel winds automatically, and holds sufficient rope for ordinary purposes.

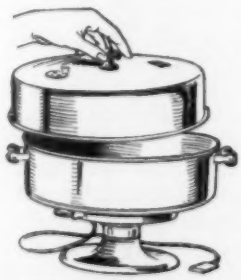


Serviceable Reel for Clothesline

For kitchen purposes a signal clock has been devised which embodies convenient features for a cook. The circumference of the dial is marked in minute periods and after each of these characters is the name of some dish requiring the indicated number of minutes for cooking. The call hand is set when a dish is placed in the oven or on the stove. At the proper time the alarm rings, indicating that attention should be given the food.

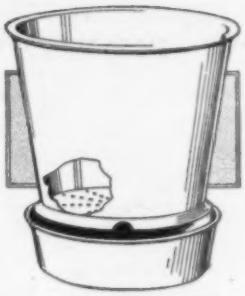


Alarm Clock Designed for Kitchen



Electrically Heated Baking Oven

Suitable for general baking purposes in a small family, a neat electric oven is made after the pattern of a roasting pan. It is constructed entirely of pressed steel and is intended to be connected to a lamp socket. An auxiliary section, which fits in the middle, increases its size sufficiently to receive large roasts or chickens.



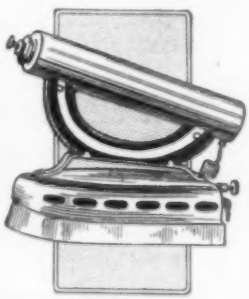
Sink Pan with Grease Trap

To prevent the clogging of the drain pipe of a kitchen sink, a refuse pan now made is provided with a grease trap. This permits only water to pass through the strainer when parings and meat scraps are scraped from dishes and cooking utensils.

An adjustable swinging gate for porches and staircases in homes where there are small children, has been invented. It is made of hard wood, and in one size is capable of being extended 3½ ft. This feature makes it especially useful for persons whose residence is temporary. When not in use it may be stored in a small space.

Adjustable Gate for Porches

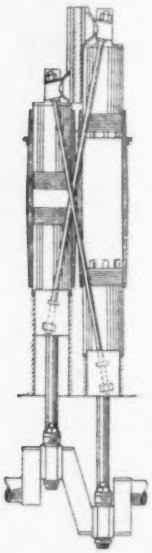
In a self-heating flatiron that has lately been invented, the fuel, consisting of gasoline under air pressure, is carried in a tubular handle. This eliminates the customary tank, characteristic of similar devices. Six ounces of gasoline is sufficient to operate the iron for approximately four hours. The heat is regulated by a small knob at the rear. It is especially convenient for outdoor work, and for use in homes which are not supplied with electric current.



Cylindrical Handle Holds Fuel

ENGINE WITH TWO PISTONS FOR EACH CYLINDER

A simple and practical solution of the problem of making an internal-combustion engine in which the pistons are forced apart by the explosion of the gas between them has been worked out in England. This engine necessarily has two cylinders with piston rods working side by side on one shaft. The cylinders have open ends and the top piston in each cylinder is connected by a diagonal rod with the bottom piston in the other cylinder. With this arrangement the cylinders work alternately and the power is transmitted equally to both crank arms when the pistons in either cylinder are thrust apart by an explosion. The obliquity of the diagonal rods is small, being less than the maximum obliquity of the rods that connect the piston rods with the crank arms. The engine is of the two-cycle type, and each crank arm therefore receives two impulses to each revolution of the shaft.



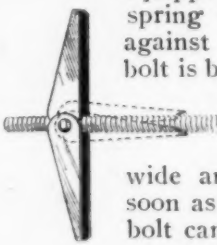
HEADLESS SETSCREW THAT DRIVES FLUSH

A new headless setscrew is designed to be driven flush with the surface, and is particularly adapted to use where frequent adjustment is necessary. The upper end of the screw is hollow, and the inner face is provided with six dovetail slots, while the special wrench used in handling the screw has six flukes that fit into these slots. The dovetails are of such shape that when the screw is being driven hard, the special wrench gives it a true rotary motion without any tendency to expand and crack the hollow portion of the screw.

New Headless Setscrew: The Dovetail Slots are so Shaped That the Special Wrench does Not Expand and Crack the Screw

NEW BOLT WITH FOLDING TOGGLE

A recently invented bolt, designed for working in close quarters, is equipped with a double spring toggle which folds against the sides while the bolt is being slipped through the hole, and springs outward and furnishes a wide and solid bearing as soon as it is released. This bolt can be used with a nut or as a screw bolt. The toggle is arranged to work on the screw threads when it is used as a screw bolt.



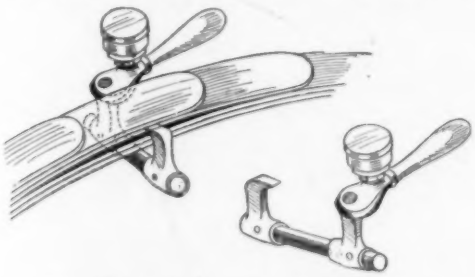
NEW APPARATUS FOR MAKING WATER GAS

Plants for producing water gas are as a rule operated on the intermittent principle, about 60 per cent of the time being given to actual gas making and the remaining 40 per cent to heat regeneration and clinkering. The greatest difficulty with plants designed for continuous operation has usually been that they were too wasteful to be operated economically. A continuous plant that works along entirely new lines has recently been invented, and it is claimed that this plant satisfies all the requirements of economical operation. In this plant the large installation of steam boilers usually employed with a water-gas plant is omitted, and the steam is obtained from a water tank placed beneath the fuel bed, and arranged in such a way that the water is evaporated by radiation from the

heated water gas as it leaves the plant. One of the essential features of the apparatus is an arrangement for the admission of superheated air to the fuel bed.

SIMPLE INSTRUMENT OILS MOTOR-CAR SPRINGS

For oiling motor-car springs properly, distributing grease where it is needed and not over the outside, a lubricating instrument has been invented which separates the leaves of a spring easily and inserts oil or grease between them. The device consists of an eccentrically mounted wedge supplied with a grease cup which forces its contents through an orifice in the tool into the space between the leaves. In use, the instrument is placed over a spring, and by pulling its handle, the wedge is drawn between the metal layers, parting them sufficiently so that

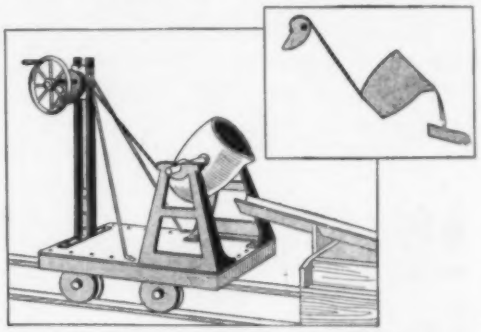


Motor-Car Springs may be Oiled with This Instrument in a Few Minutes

a turn of the cap on the grease cup pushes the lubricating compound into the proper place.

NEW DEVICE FOR TILTING HOT-METAL LADLE

Tilting a ladle so that the molten metal will be poured in an even and smooth stream is an operation requiring much skill when done by the usual method. An ingenious device recently patented is designed to do this mechanically. The ladle rotates on fixed bearings, as shown, and is tilted by a cable attached to the back. The feature of the invention is that the cable passes over a cam which rotates at a uniform speed. As the cable is wound on the cam the speed of tilting gradually increases so that the rate of flow from

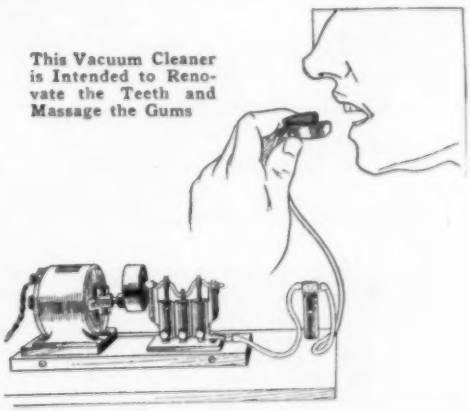


Molten Metal is Poured from the Ladle in a Uniform Stream

the spout of the ladle is exactly the same at all stages of the process of emptying.

VACUUM CLEANER FOR TEETH NEW DENTAL APPLIANCE

Among the recently invented dental appliances which are being introduced, is a vacuum cleaner for the teeth. This is intended to furnish a method for removing small particles of foreign matter which cannot be reached easily by other processes, and also to stimulate blood circulation in the gums. The device consists of a three-cylinder exhaust pump which is operated by an electric motor. A mouth cup which fits



This Vacuum Cleaner is Intended to Renovate the Teeth and Massage the Gums

over the teeth and gums is connected to this by a rubber tube, and between these two members is placed a re-

ceptacle in which the matter removed during the renovation process is collected.

SHAVING SOAP PUT UP IN WOODEN BOWLS

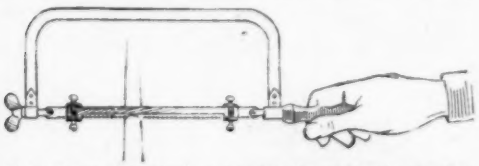
A London firm of perfumers has brought out a novel shaving-soap package that does away with the necessity

Wooden Bowl Used in Place of a Shaving Mug

for using a shaving mug. The soap is packed in a wooden bowl with which are provided a wooden handle that screws in at one side, and a wooden cover. The bowl answers the purpose of an ordinary shaving mug, and when the soap has been used can be thrown away.

GAUGE FOR LIMITING CUT OF HACKSAWS

A new depth gauge for hacksaws consists simply of a metal strip made of pressed steel and attached to the



This Gauge Attached to the Hacksaw Limits the Cut to Any Desired Depth

saw at the ends by setscrews. It is easily set to limit the cut to any depth. This gauge is adapted to a great many uses and is designed particularly for such work as cutting into flexible electric-wire conduits, where, without such a gauge, there would be danger of injuring the interior insulation.

¶From 1909 to 1914 the estimated amount of concrete pavement in the United States increased from 364,000 sq. yd. to 19,200,000 square yards.

NEW TOOL HOLDER HAS CAM FOR SETTING TOOL

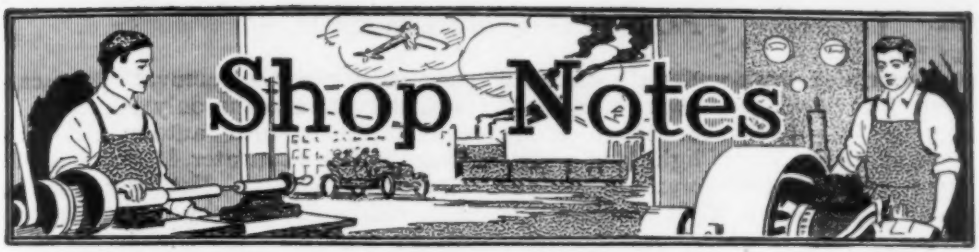
A tool holder just placed on the market and designed for lathe and planer work is equipped with a cam which is used in place of the usual setscrew for holding the tool in position. A number of important advantages are claimed for this arrangement. The holding efficiency of the cam is said to be greatly superior to that of the setscrew, while the greatest disadvantage of the setscrew, the breaking of the head with the trouble that results from such an accident, is entirely done away with. With the new holder the tool is quickly and easily secured by turning the cam

New Tool Holder Equipped with Cam for Setting the Tool

through an angle of about 30°. The cam has a hexagonal end and the equipment includes a special wrench for setting.

COAST POSITIONS ATTACKED BY SUBMARINES

Bombardment of coast cities and of military works ashore has been successfully carried out on several occasions during the present war by submarines operating at short range. The first of these attacks occurred early in August, when a British submarine bombarded the Zeitunlik powder mills on the eastern side of the Bosporus, near Constantinople. Several weeks later a German submarine bombarded the towns of Whitehaven, Harrington, and Parton at the entrance to the Solway Firth on the west coast of England. Submarines carry guns of small caliber, but they are able to approach a coast unobserved, especially at night, and can then rise to the surface and open an effective fire at short range.



The Private Garage

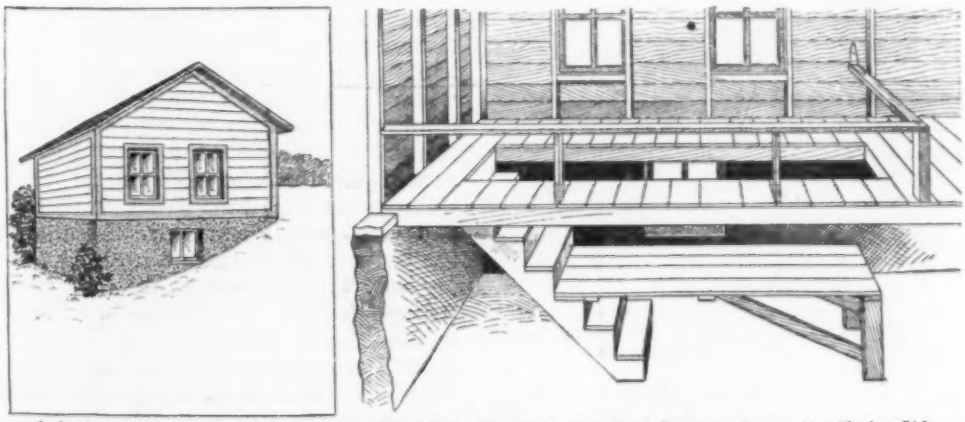
By JAMES STANTON

SINCE private garages are usually built as ground-floor or one-story structures, with practically no space under the floor, a convenience like a pit appears a luxury, for the expense of digging and properly lining and protecting the walls is out of proportion to the benefits derived from it. But such buildings, if set on sloping ground, offer all the possibilities of a pit with but few shortcomings, as will be detailed.

When, as is often the case in suburban localities, the lot on which the garage is to be built slopes from 4 to 10 ft. in the length of a building, substantial supports must be provided for the elevated side. It may be that a basement, or cellar, is excavated to the lower level and a floor put down, or the ground may be left in its natural slope, but in any case the expense of inclosing the space below the main floor is not large, and the future will prove it worth while. A garage so built may have a trapdoor in the floor, and a man standing below can work at the under side of a motor without stooping. An inspection lamp will only supplement the natural light that will come from below, and a dropped object can be located with ease.

Such a pit does away with crawling on the floor, lying on a creeper and holding a light in one hand while assembling two or three pieces with the other; with the grease and litter of the average floor, and the discomfort of having to work in a strained position. Moreover, inspections and adjustments of hard-to-get-at parts are often neglected when there is no pit.

An excellent example of a private garage embodying some of the features mentioned was found in a barn built on a hillside, which was converted into a garage. It was a single-story affair and had at one side of the large room a stairway leading to the cellar, or basement. It was decided to utilize



A Stairway in the Corner of a Large Barn Floor Makes an Excellent Place to Get at the Under Side of an Automobile for Adjustment or Making Repairs

the stairs for work under the car. To that end two windows were cut through the wall near them, which gave an abundance of light, and a platform was built that formed a floor at a convenient level. This platform was strongly constructed, one end resting upon the stairs, and made wide enough to prevent articles from falling off. It did not require any fastening and could be easily moved out of the way when not wanted.

The trapdoor over the stairs was removed, and a substantial railing built around the opening. A hinged bar, lifted to permit a car to run over the hole and dropped back into place when the car is moved away, made the opening perfectly safe. A construction such as this is feasible also for a public garage wherever state regulations permit any floor opening at all. It is cleaner and lighter than a pit, and more comfortable for the workmen. The addition of a trapdoor, working automatically with the removal of the car, would overcome the only objection.

Experience with automobiles has taught that rainwater is the best to use in radiators. Yet few use it, although it is as easy to get as to attach a hose to the faucet. Provide a gutter on one side of the garage roof and a short length of pipe leading from it, together with a substantial barrel, or half barrel. That is all the initial investment and there is no upkeep cost, for no meter need be applied. A spillway, or drain, will naturally be laid to carry off the water from the roof, and the barrel will stand on this and overflow into it. A more elaborate arrangement would be to set the barrel with the top at the height of the eaves, in which case the water may be piped to suit the requirements. A few drops of kerosene on the water every 10 days will prevent the breeding of insects. This will provide a good supply of the softest water obtainable.

Road Roller Made of an Old Boiler

One of the old-style boilers without an attached fire box, or an upright one, makes a fine road roller. In building roads in a southern state, one of these boilers was used. A hole was drilled through the center of each head, and a shaft run through them, the ends being used for hauling it over the roadway by means of a special-built frame and tongue for a team of horses. The heft of the boiler was sufficient to pack very loose soil to make a solid roadbed.

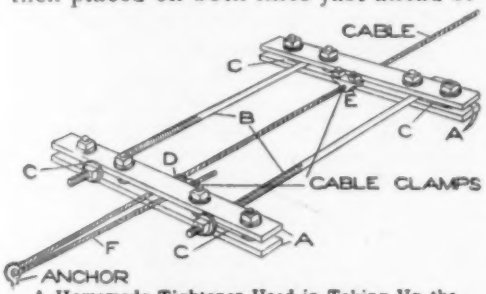
An Old Boiler with Frame Attachment for Use in Rolling Soil for a Roadway

Makeshift Tightener for a Guy Line

One day while working for a mining company, I was sent alone up an incline to tighten the guy line on a sheave-pulley frame. The only tool I had was a small monkey wrench, and when I arrived on the job I had to think of some easy way to do a hard thing. I thought of a way and returned to the shop for some cable clamps and two long bolts with nuts and washers. I run more threads on the bolts to make them 8 in. long. On my way back along the railroad track I found four fishplates and bolts, used to join the ends of rails. With these parts assembled, I soon had a tightener ready to work as shown in the illustration.

The fishplates are shown at A, with

the bolts in place, drawn just close enough so that the bolts B move freely. Four wood blocks were fitted and placed in at C, to keep the bolts B close up to the center bolts of the fishplates and to keep them in line with the cable. The cable clamp was placed on the loose end of the cable, at D; then the fishplates were spread apart as far as possible, and another clamp fastened to the cable, at E. It was only necessary to turn the nuts on the bolts B to take up the slack in the guy line. When the end of the threads was reached, the line was still slack and needed more tightening. A clamp was then placed on both lines just ahead of



A Homemade Tightener Used in Taking Up the Slack in Cable Guy Lines

the anchor bolt, at F, to hold the slack taken up. The tightener was then reset and used as before.—Contributed by E. C. Lane, El Paso, Texas.

A Method of Applying Gold Leaf Economically

Recently I had quite a lot of gold leaf to apply and was assisted very materially by a stunt I found in an old English sign painter's manual. The directions called for a paper prepared in a certain way, but I used ordinary paraffin wrapping paper as a substitute.

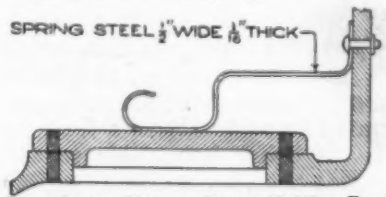
Taking the pieces of paraffin paper, I placed them carefully over the gold leaf in the book and rubbed them with my fingers. The gold adhered to the paper and could be handled without danger of its blowing away. When placed against the sized surface and rubbed with a piece of cotton, the paraffin paper allowed just enough gold to be released to cover the sized surface. The illustration shows the gold leaf on a sheet of the paper and how it appears when the gold has been re-

Handling Gold Leaf with Paraffin Paper to Prevent Waste and for Covering Only Necessary Surface

moved to cover the surface of a letter. —Contributed by James M. Kane, Doylestown, Pa.

Holding Spring for a Gear-Box Filler Cover

The small cover closing a hole through which the grease was poured into a gear-box case was held in position by means of two studs with ordinary wing nuts. The nuts would become loose and drop out, and the studs, being made of very soft material, wore badly. It was finally decided to discard the stud-and-nut method of holding the cover, and the arrangement shown was substituted in its place. The studs were first removed from the case and the holes left by them filled with lead. A piece of flat spring steel was bent into the proper shape and



A Stout Spring Makes a Better Holding Device for a Gear-Box Cover than Bolts

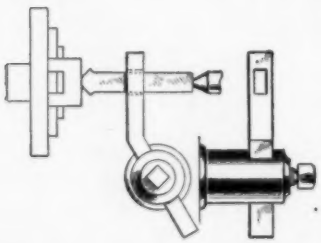
bolted in such a position that its end pressed at the center of the cap. In this manner the troublesome nuts were eliminated, and the advantage of having a cover device that could be quickly operated was gained.

Ice Creepers

In crossing a pond in winter where the ice would carry my weight, I found it difficult to travel when a very light snow or frost had fallen. To save time in traveling and to prevent slipping, I purchased two skate straps and made creepers of them. They were cut to a length to reach over the ball of the foot, as shown. The portion of the strap under the shoe sole was filled with tacks so that their points would enter the ice. I can now walk over the ice without fear of falling.—Contributed by W. A. Potter, Lexington, Mass.

Guard Holder for Flat Drills

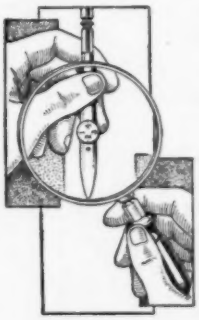
The common flat drill, used for drilling preliminary boring holes in chucked work on the lathe, is held in various ways to suit the convenience of the lathe operator. It is, of course, not only necessary to hold the drill rigidly so that it will not turn, but the center of the tailstock, holding the end of the flat drill, must be operated so as to act as a feed for the drill. It being impossible to do two things at once, an accident is often the result of trying to perform such an operation, as a wrench cannot be relied upon to keep the drill from turning.



The sketch shows a jig, held by the tool post and provided with a slot, through which the flat drill passes. The only attention required of the operator is to feed the drill by the center of the tailstock. The jig can be easily and quickly centered for the drill. It is also an excellent safety device, for it is impossible for anything to get caught, or fly around and injure the operator of the machine, since the common flat drill, when ground correctly, will not dig or drag into the work in the chuck, cutting only when it is forced by the pressure applied to the center of the tailstock.—Contributed by F. W. Bentley, Missouri Valley, Ia.

Calibrating Thumbscrew on a Ruling Pen

It is quite difficult for the beginner in a drafting room to set the nibs of the pen each time to draw uniform lines. This can be done accurately if the thumbscrew is calibrated and a mark made on the nib of the pen as shown. It is an easy matter to turn the screw a certain number of times to a mark that will set the nibs the same distance apart each setting.—Contributed by A. Jaminet, Denver, Col.



Softening the Harsh Tone of a Violin

All violins of the inexpensive kind, and many high-priced ones, have a loud, harsh, and unmusical tone. A good remedy for this is to purchase a new bridge, and instead of cutting it down, drill holes just large enough for the strings as shown. If the sound is too much muffled, trim a little off from the top of the bridge until the proper tone is secured.—Contributed by C. E. Wurth, New York Mills.

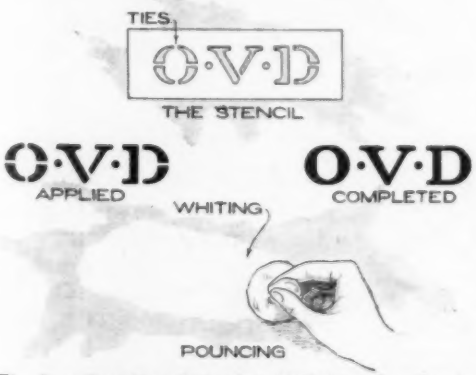
Stenciled Initials or Monograms on Automobiles

By JAMES M. KANE

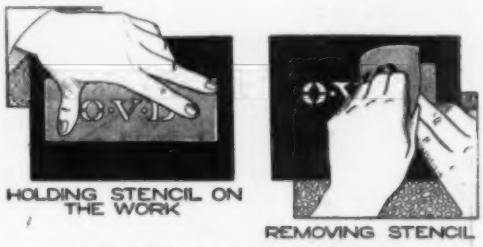
THE practice of placing the owner's initials, or monogram, on some portion—usually the doors or side panels—of the automobile is becoming more common, and with a good reason. Possibly it was unnecessary some years ago when cars were few and not many alike, but with the rapid increase in the output of cars, especially of the lower-grade cars, there are considerably more cars alike, and since the majority of car owners probably could not remember their license numbers if put to it, there is need for some identifying mark that can be distinguished at a glance.

I find that the use of a carefully cut stencil insures clear, quick work, as it can be placed on the exact spot without resorting to the preliminary outlining, trial marks, and spacing lines necessary when working in the usual way. As the high gloss on the varnished surface of an automobile will show the least scratch, the fewer preliminary marks the better, hence the stencil for safety. In addition to this, it can be put away for future use, insuring the car owner of an exact duplicate of the letters when the car is repainted, or when another car is purchased.

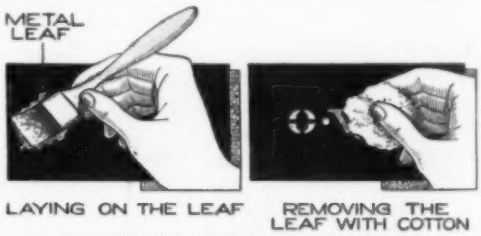
Ordinary stencil paper is not so good for the work as heavy, smooth-surfaced writing paper, or bond paper thinly coated with shellac. As the blank spaces left by the ties in the stencil are afterward filled in so as to form a complete letter, these ties can be left at portions of the letters that are most likely to curl up. Ordinary stencil work requires that the ties be placed with due regard for the general appearance of the finished work, as the tie spaces are not filled in. The stencil described must lie flat at all points, and the ties are designed with this object in view. The ties should not be too heavy.



The Stencil as It is Cut; after Applying; Completed Letters; Sized and Pounced



Applying and Holding the Stencil in Position, and Removing It after Painting the Surface

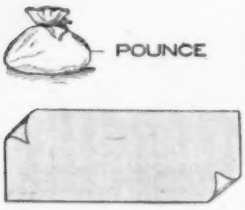


Applying Metal Leaf with a Camel's-Hair Brush and Removing the Surplus Leaf

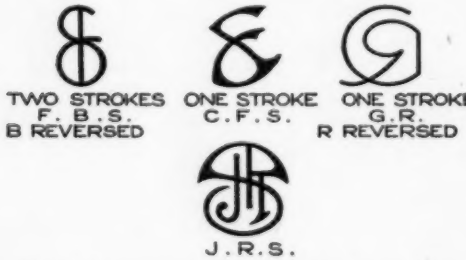
As the stencil will lie closely to the varnished surface, the finger nail would seem to be the most natural thing to use in removing it, but as this would be likely to result in a scratch as well as in smudging the letters, the best plan is to turn up two corners of the stencil, either of which can be easily grasped and the stencil lifted off without trouble. The color used should be almost dry so that it will not slip beyond the outlines of the letters. After the stencil has been removed, the color can be used more freely in going over the letters and filling in the spaces left blank by the ties.

While color gives very satisfactory

results, metal leaf is much better, as it insures an even surface, wears better, and shows no brush marks. Gold or silver leaf may be difficult for the amateur letterer to handle, but aluminum leaf is stout enough to be applied by the inexperienced person. Gold leaf is now put up on prepared paper that can be laid over the work and gently rubbed, causing only the gold that comes in contact with the painted or sized surface to adhere, the balance of the leaf remaining on the paper.



The work should be pounced if metal leaf is applied, as the least tackiness of the varnish will cause the leaf to stick where it is not wanted. The pounce is merely a small bag made of fine cheesecloth, filled loosely with whiting. This is dabbed on the surface and forms a resist against the leaf. It does not prevent the paint or size from adhering, however. A wet sponge removes the whiting after the letters are dry.



Original Monograms, Showing How Three Letters may be Combined to Make an Individual Mark

While letters are sufficiently distinctive, the use of a monogram adds an air of exclusiveness and individuality to the job and removes it from the commonplace.

¶In taking pipe apart when the joints are stuck so that they will not turn, heat the coupling or fitting; or hammer it, not the pipe, and the pipe can be easily unscrewed.

Making Use of Broken Concrete-Sidewalk Material

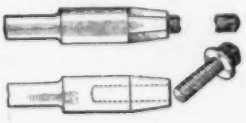
Through a mistake there was delivered to my house a load of defective concrete-sidewalk material that had been torn up by the contractor for replacement. Not caring to pay for hauling it away, I sought some use for it, and found such a satisfactory one that I am going to get another load, which can be had for the hauling, as usually the contractor must haul it a long distance to dispose of it.

I squared up the concrete into flags with a cold chisel, and with the various sizes matched up on the edges, it made an excellent 2-ft. walk through the poultry yard. The ground was excavated about 5 in. deep, and filled in 1 in. with heavy soil. Then water was turned into the trench, making a slush, and while in this condition, the flags were set in and forced into the slush, which ran up between them. The soil, when dried out and hardened, made a firm base conforming to the uneven bottom surface of the flags.

With the odd broken pieces and chips, I constructed four drains directly under the drain spouts from the house, carrying the water well into the soil and into the garden bed, where it can be used to better advantage than on the lawn. This also avoided the gullies on the lawn that heavy flows from the drain pipes are apt to create.—Contributed by Victor Labadie, Dallas, Texas.

Repairing Pedal Crank on a Motorcycle

The weakest point on the crank hanger of a motorcycle is the threaded projection on the end, and this usually is broken in case of a spill. The usual remedy is a new crank, but this expense can be avoided by the simple repair shown. The end of the broken part is filed, or ground down, level with the shoul-

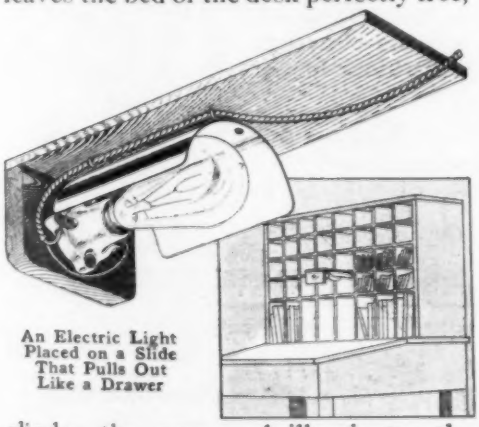


der, and a hole drilled and tapped for a machine screw. This will not only hold as well as before, but it will make possible a quick repair on the road in case it is damaged in a like manner.—Contributed by E. K. Marshall, Oak Park, Ill.

A Disappearing Desk Light

On high desks, such as bookkeepers use, the ordinary standing lamp is in the way, not only during the day, but also when in use among large books. This condition led me to contrive a light which could be pushed into one of the pigeonholes when not in use. A thin board was cut as long as the pigeonholes are deep and just wide enough to slide freely in and out. The front piece was then nailed on, and a small brass knob placed in the center. A lamp receptacle was then screwed on, and a piece of bright tin bent into a semicircular shape to serve as a reflector. Tack this to the board and then fasten in a thin strip of wood on each side of the pigeonhole near the top for the board to slide on. Screw in the lamp and connect up with a flexible cord, which should be run out through a hole in the back of the desk, leaving the cord sufficiently loose to permit the lamp to be drawn out.

A light arranged in this manner leaves the bed of the desk perfectly free,

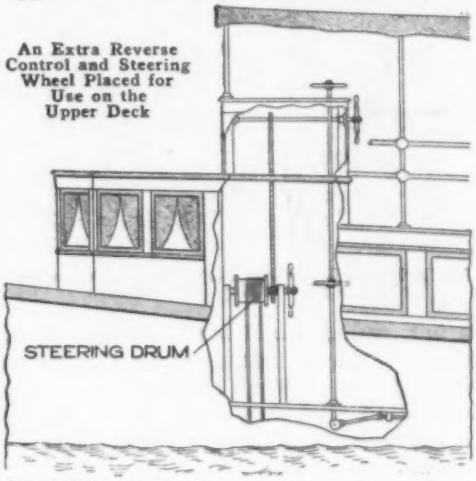


An Electric Light Placed on a Slide That Pulls Out Like a Drawer

shades the eyes, and illuminates the work in a very satisfactory manner.—Contributed by John D. Adams, Phoenix, Ariz.

One-Man Control for a Double-Deck Boat

In my seagoing yacht I installed a one-man control after building an upper deck so that the boat could be



An Extra Reverse Control and Steering Wheel Placed for Use on the Upper Deck

handled from either deck. The added control and steering device was practically the same as used in the wheelhouse. The rod controlling the reverse was simply extended to the deck above, and a handwheel attached to it. The wheel used was one purchased from an automobile dealer, taken from a steering post of an automobile. A sort of countershaft was installed, carrying the extra steering wheel on the rear end and a sprocket from which a chain was run to the steering-drum shaft.—Contributed by W. F. Quackenbush, New York City.

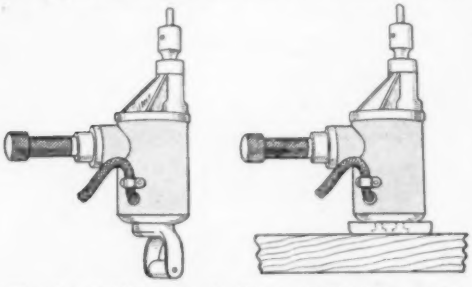
The Appearance of Casehardening Given to Steel

A solution of 1 part nitric acid to 20 parts of water will produce a surface on polished or ground steel to give it the appearance of casehardening. Immerse the object about 20 seconds, then rinse in cold water.

¶Most drills are broken by unfair usage, such as crowding too hard before the drill has entered its full cut, or after the point has come through the work.

Base for a Motor Drill

A decided improvement on motor drills, as shown in the illustration, is to replace the handle on the head with



The Attached Base to the Motor Drill Makes a Flat Surface for Setting It on a Bench

a flat, round wood base, about 1¼ in. thick, with a diameter equal to the body of the motor. This will allow the motor to stand on end, which makes it most convenient for the insertion of drills.

It is also a safety attachment, as in taking hold of the motor by the chuck end, it can be placed almost anywhere on a machine with safety and without danger of rolling off. It makes a better breast pressing surface, and once used, will never be discarded. It also makes it possible to use the motor as a speed lathe for dressing up the ends of taper pins, and the like.—Contributed by Russell Hollis, Chicago.

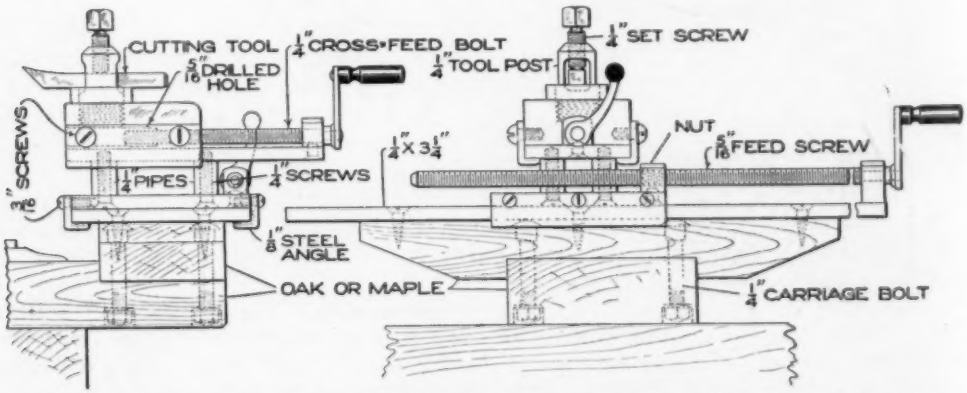
¶Do not put up cleats on electric wiring with nails.

A Compound Rest for a Wood Lathe

Metal turning is rarely done on a wood lathe, and, if attempted at all, the hand tools used give poor results. By adding a compound rest to a wood-lathe equipment, its scope is broadened, and even steel and cast iron can be turned if the diameter is not too large. It is also very useful in wood turning, especially so on accurate taper work and patterns.

The base is made of oak, or maple, wood, as shown, the lower piece being slotted to admit a clamping bolt. The shears and carriage body are made of cold-rolled steel, 3¼ in. long by ¼ in. thick, and the shear for the cross slide, 2 in. long and ¼ in. thick. The general dimensions given in the sketch are for a rest to fit on a lathe of 9½-in. swing. In fitting the angle pieces, care should be taken in drilling the screw holes and in fitting the screws. The main, flat shear is fastened to the base wood member by means of six large wood screws. The two wood pieces are clamped together on a glued joint with four ¼-in. carriage bolts.

The cross slide is fastened to the carriage plate with four ¼-in. flat-head machine screws, and is supported by four pieces of ¼-in. pipe of equal lengths. The cross-slide tool block has a ¼-in. tapped hole in the rear, and this is counterbored to 5/16 in. in front, to provide clearance for the feed screw. This block has a ¾-in. tapped hole in

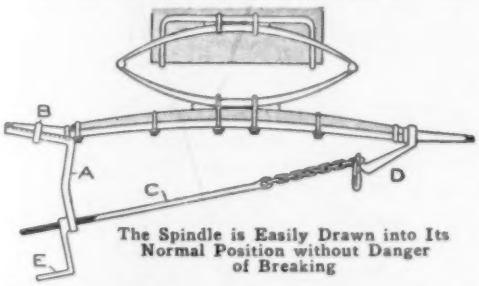


A Compound Rest Adds Greatly to the Equipment of a Wood Lathe, Which Makes It Possible to Turn Accurate Tapers as Well as to Turn Small Diameters in Metals

its upper surface for the tool post. Tools made of ⅜-in. steel are ideal for all purposes. Small boring bars can be made of the same material and a hole drilled in one end to hold 3/16-in. round steel tools. The end of the bar is then split, and a 3/16-in. setscrew used to clamp the tool tightly.—Contributed by Joe V. Romig, Allentown, Pa.

Buggy-Spindle Straightener

Any blacksmith can add, by using a little spare time, a very useful tool to his shop, to straighten buggy axles quickly. The one shown is made up as follows: The arm A is made of a 1-in. square steel bar, bent as shown, and the shorter end grooved to fit the axle, a ring, B, being used to hold them together while in use. The other end of the bar is slotted to receive the threaded end of a ½-in. rod, C, that is 2 ft. long. A piece, D, is forged to fit over the other spindle, close to the

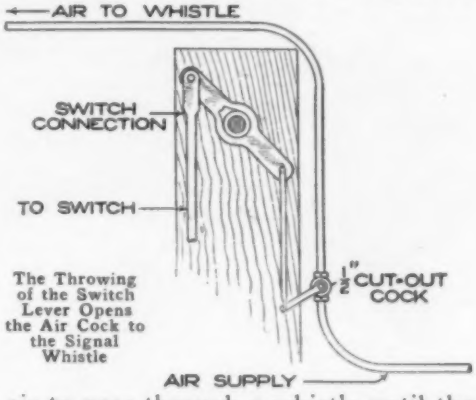


The Spindle is Easily Drawn into Its Normal Position without Danger of Breaking

back, or larger, end, with a hook on the opposite end for attaching a chain that connects the two pieces. A crank, E, threaded to fit the ½-in. rod, is used to draw the bent spindle straight.—Contributed by D. C. Goff, Knoxville, Tennessee.

An Alarm Signal for Repair Tracks

In freight-car repair yards men are subjected to a great deal of danger, and many accidents have resulted in pulling cars from the running repair tracks. In order to prevent accidents and give men warning that the switch leading to such a track is open, and to keep from under the cars, the device illustrated was put into service. Air is always piped along these tracks for use in testing out air brakes, and the air pipe from the device is coupled to the air line. When the switch on the repair track is opened it opens up the cut-out cock, allowing the

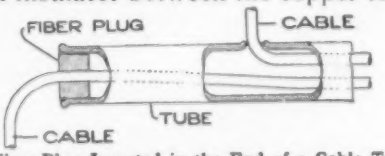


The Throwing of the Switch Lever Opens the Air Cock to the Signal Whistle

air to pass through a whistle until the switch is again closed. When the whistle stops blowing, this indicates that it is safe to go under the cars. The air pipe is ½ in. and fitted with a ½-in. cut-out cock. The length of the arm that works the cock lever is optional and is made to suit the conditions.—Contributed by J. R. Minter, Washington, Ind.

Keeping Cable Tube Clean on Automobile Engines

In overhauling an automobile engine recently we noticed that the tube carrying the spark-plug cables was so clogged with grit and dust that it was impossible to remove the cables. This trouble can be easily avoided if both ends of the tube are plugged in some manner, preferably with a piece of hard, red fiber, as this forms a very good insulator between the copper tube

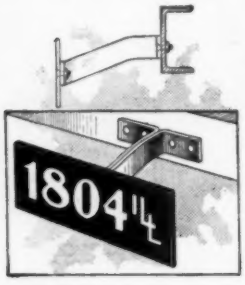


A Fiber Plug Inserted in the End of a Cable Tube to Keep Out Dirt

and the wire cable. The illustration shows the end of one of these tubes with a fiber plug inserted.—Contributed by Adolph Kline, New York City.

Number-Plate Bracket for a Motor Truck

A quickly made bracket for a truck number plate can be constructed from two pieces of ⅜-in. by 1½-in. cold-rolled steel, hammered in the form of the letter "C" and riveted in the position shown. It is best to rivet the bracket to the vehicle frame, but it can be fastened by means of small machine screws. To give the plate a neat appearance, flat-head screws should be used with the heads facing the plate.



Blower for a Small Forge

Having constructed a light forge, I had no way to furnish the blast unless a fan was made, and not wanting to take the time for making one, I used our vacuum cleaner as follows: The hose attachment to the cleaner was fitted to the discharge pipe and run to the forge tuyère; thus obtaining as good a blast as could be desired for the forge fire.—Contributed by Luther Turner, Beardstown, Ill.

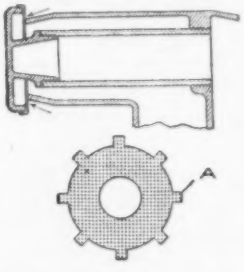
An Emergency Torch

Procure a piece of pipe of any metal, about 6 in. long and ¾ in. in diameter, with both ends open, and fill it with absorbent cotton, or if this is not at hand, ordinary cotton, or even common waste, will answer the purpose, but it is not so good as the absorbent cotton. A very small part of the cotton is allowed to project at one end. Pour several tablespoonfuls of gasoline or benzine on the cotton to saturate it, but not enough to make it drip. This torch will burn with an even, steady light for about 30 minutes on one filling. It will burn lying or standing, and is absolutely safe.

An ordinary case, such as used for putting up shaving sticks, makes a good torch to carry around, as it will not let the gasoline evaporate when the top is screwed in place. To extinguish such a torch place the lighted end against any flat surface.—Contributed by James E. Noble, Toronto, Can.

Covering Engine-Case Breather to Prevent Dust from Entering

The breather on a gasoline engine of an automobile serves the purpose of allowing any excess pressure in the crank case to escape, and also provides an opening to pour in the lubricating oil. The breather construction, as shown in the illustration, will allow considerable grit and dust to enter and cause havoc with all the bearings. While it is necessary to have some opening at the top, it also is a problem to keep out the dirt and dust. A piece of very fine mesh and comparatively thin brass-wire screen, cut to the shape and necessary dimensions to fit the breather cap, will eliminate the trouble. The projections A are bent over the side of the cap for the purpose of holding it in place.



An Eyeglass Cleaner

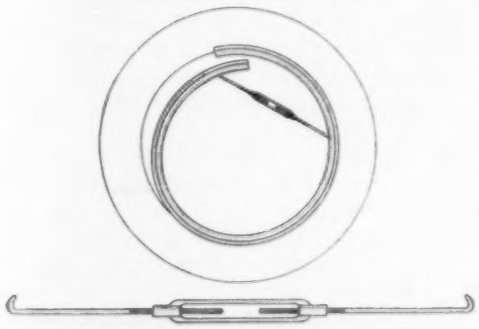
The most common cleaner for eyeglasses is a silk pocket handkerchief which is rubbed for a considerable length of time over the glass surface before they are clear. Tissue paper is an excellent cleaner but is not always on hand, and instead an old dollar bill can be used. It cleans the glasses as clear as crystal without "breathing on them." An old, worn bill is preferable to a new one.

A Convenient Demountable-Rim Tire Tool

The motorist living in a large city is not troubled with tire changes, as the service man takes care of the work. In smaller places the person who drives must make his own tire changes. The introduction of the demountable rim enables the driver to carry an extra tire and make emergency changes on the road.

Although the demountable rim is split transversely, and at first glance, the tire would seem to be easily removed, such is not the case. In fact, it is about as difficult to get the tire off the rim as it is to remove it from the old-style clincher-rim wheel. If the ends of the rim where it is transversely split could be lapped and the rim contracted, the tire would fall off of its own accord.

The removing may be easily accomplished by means of a turnbuckle, as shown in the illustration. Two holes must be drilled in the rim, one close to the split and the other about 10 in. from it. A turnbuckle, 12 in. long, can be purchased from any hardware dealer. The ends should be heated and turned at an angle, to hold securely in the holes drilled in the rim. It will be found that the stiffest rim may be contracted and the old casing removed

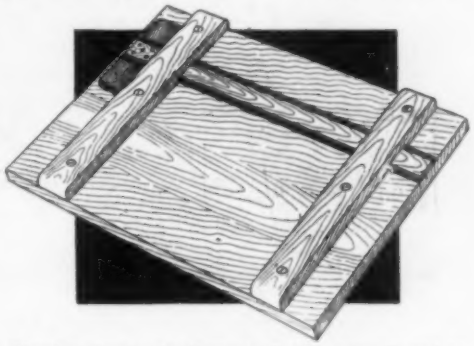


Rim-Contracting Tool for Demountable Rims, for Quickly Removing Tires in Making Repairs

with little effort, and replaced while the rim is contracted. New tires may be put on the rim in a like manner.—Contributed by James F. Gwinner, Memphis, Tenn.

Carrying T-Square on a Drawing Board

Most drawing boards have battens on the back to keep them straight. To provide a place for the T-square it is



Notches Cut in the Battens of a Drawing Board to Admit the Blade of the T-Square

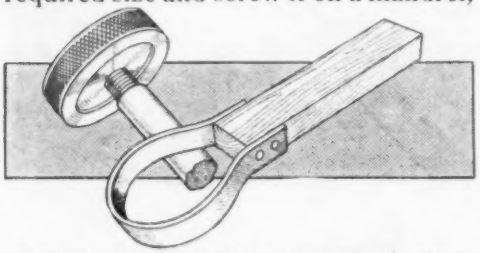
only necessary to cut out a notch in each batten on a line with each other and of a size to admit the blade. This makes a convenient way to safely carry the T-square.

Uses for Beeswax

Beeswax has been used to advantage to take the impression of a door key, but there are several other places where it comes in handy as well. When filing a key and using another key for a pattern a very small amount of the wax placed between the two and squeezed in a vise will keep them together until finished. The wax also makes a first-class fillet in pattern work, by putting it on in little pieces and then going over it with an iron just a little hotter than is necessary to melt it. It makes an excellent composition for filling holes and little imperfections in wood, where it is superior to putty, as it does not shrink and leave a depression. A small leak in a pan, or other receptacle for liquids, may be made tight for the time being by pressing a very small piece over the holes, or melt a few drops with a hot iron and let them fall on the place to be plugged.—Contributed by A. Dane, Pottstown, Pa.

Removing Milled Work from a Mandrel

Often in turning up milled edges, or fancy hand nuts, of medium thickness, it is necessary to tap the nut to the required size and screw it on a mandrel,



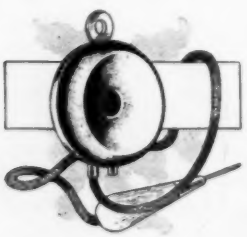
A Wrench Made of a Stick and a Piece of Leather to Remove Finished Parts from Arbors

or arbor, previously turned down and threaded and held in a lathe chuck, while finishing one side of the nut, then take it off and replace it to get at the other, or opposite, side. In turning, the lathe tool tightens the nut on the arbor so that it is necessary to use a vise and wrench to remove it, thus damaging the finished part.

To prevent marring the partly finished piece, I simply screw the arbor in the vise, then remove the piece with a wrench made as follows: A piece of leather belting, any convenient width, is nailed on a strip of wood to form a loop, which is placed around the finished part and used in the same manner as a chain pipe wrench.—Contributed by W. E. Day, Pittsfield, Mass.

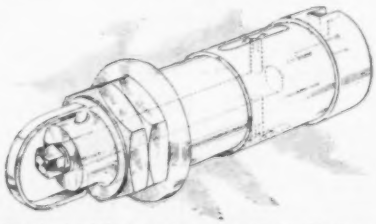
Live-Wire Detector

It is not generally known that if one terminal only of the ordinary telephone receiver is placed in contact with a wire carrying the usual 110-volt commercial lighting current, a faint buzzing sound will be heard. This static effect not only shows the extreme sensitivity of the telephone receiver, but affords a convenient and absolutely safe means of identifying live wires without endangering the fuses or disconnecting. For work among covered wires, the end of the single conductor from the receiver may be connected with a darning needle firmly set in a small awl handle, which will readily penetrate the insulation.



Greasing Crosshead Pins

Considerable trouble was experienced in lubricating crosshead pins with oil, which resulted in adopting other means of lubrication. Pin grease was used successfully on the side and main rods of the locomotives for lubricating the brass and crank pin, and the idea embodied in the sketch was worked out, which clearly illustrates the method. The grease is put into the cavity, and



A Method of Lubricating Crosshead Pins with Grease, and a Substitute for Taper Pins

the plug forces the grease into the slots cut in the bearing surface of the pin.

In order to overcome delays in removing bent taper pins, which were used to prevent the nuts from working off the crosshead pin, a spring ring was devised. The sketch shows the method of its application. To remove the device, insert a chisel and pry the ends out of the holes.—Contributed by J. R. Minter, Washington, Ind.

Holding Tools in Their Handles

A good adhesive for holding tools in their handles is rosin and a small quantity of rottenstone. The hole in the handle is filled with the powdered rosin to which has been added a little rottenstone. The tang of the tool is heated and pushed into place. When cold, it will stick firmly in the handle.

BUILDING A HOME

By Geo. M. Petersen

PART VIII—Interior Woodwork

THERE are probably very few persons outside of the building profession who fully realize the effect of the interior finish on the general appearance, sale of the property, and the amount of a mortgage loan. Most people build for themselves, but it is well to bear in mind the fact that emergencies may arise necessitating the sale of the property to tide over a temporary financial depression, or the owner may be forced to change location from one state to another and therefore must dispose of his real estate. He may outgrow the home and want the money invested to build again and on a larger scale; he may desire to move to a new and better neighborhood, or have any other of the numerous reasons for selling his property. On this account it is well for the prospective home builder to consider his house from the practical side as well as from the ownership ideas of what is right. Keep away from "freak" notions, unless money is no object, and then think twice before incorporating them into a home. Keep the cost of the house as low as possible with the use of first-class material and workmanship. If this is done, it will be an easy task to unload it at a small profit any time it may be necessary or convenient to do so, but a house poorly finished on the interior is sometimes a hard thing to sell.

The bank, or individual, to whom a person applies for a first-mortgage loan will first learn the cost of the lot; the cost of the buildings and improvements, such as sewer, city water, pavements, gas, electric lights, etc.; amount of loan desired; the amount the builder can pay back each year, and the rate of interest. If, with these facts before him, the prospective mortgagee thinks it a good risk he sends out an appraiser to check up and see whether the information given is correct. The appraiser generally secures land values from the recent sales in that vicinity, but when it comes to the building he is his own judge as to the value. As

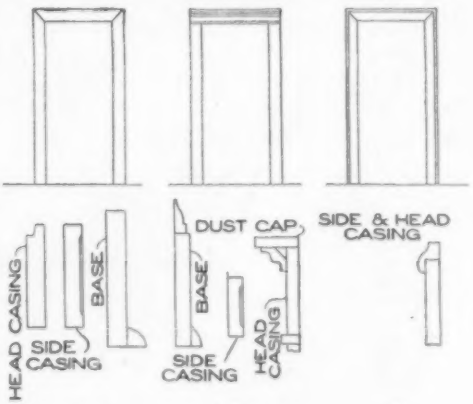


FIG. 1

Three Styles of Finish Most Commonly Used: The Mitered, the Cabinet-Head, and the Back-Band

these appraisers are sometimes real-estate men, and often contractors and builders, it is almost certain they will

value the building at its actual cost. Nothing depreciates a building as rapidly as poor interior finish. A large

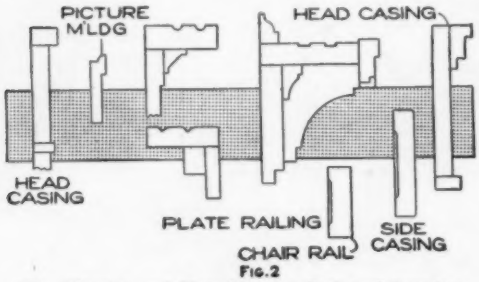


FIG.2

The Mission and Near-Mission Styles of Interior Trim That are Sometimes Used

number of builders and contractors make up an artistic exterior, but fall down on the inside work.

To have good interior finish does not necessarily mean that the material must be expensive, but rather to have the best of its kind and properly worked. At one time I appraised two houses of approximately the same size and almost the same design, where I disapproved the loan on one which was really the more expensive, as it was finished in oak and birch, but approved the other and cheaper one that was finished in yellow pine. This was due to the fact that the yellow-pine trim was clear and free from imperfections and put up in a thoroughly workmanlike manner so that it would stand the test for years to come.

The more expensive house, while finished in fairly expensive woods, did not pass inspection because of defects

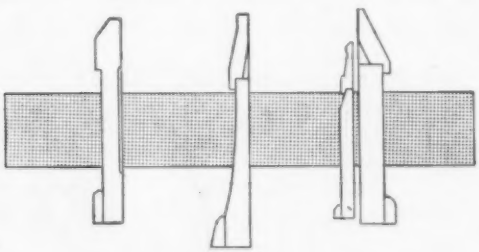


FIG.3

Three Styles of Baseboards Used in Connection with the Trim for the Door and Window Casings

which the carpenter had not taken the time to cut out, and also because of the workmanship being very poor. In a short time the owner could not get half the cost for it. Putty, stain, and varnish cover a multitude of carpenter's errors, but even the inexperienced eye soon learns to observe that something is wrong. One or two defects will cause a look for others, and in a short time he will become dissatisfied, and the once cherished home will not have its pleasures as anticipated.

What is said in the foregoing paragraph applies to prospective purchasers as well. Houses in which the joints in the woodwork have started to "pull," or open up; where the putty is leaving the edges of the wood, and where the surface of the varnish is dulled by the oil from the putty used to cover some imperfection; in which defective material or workmanship is apparent, are almost impossible to sell, and few real-estate men will waste their time in trying to dispose of them.

Kinds of Material

White pine is used where a good but inexpensive wood is desired. In certain localities it is only used where the surface is to be painted, as the wood is too soft to stain nicely, but it may be dyed with good results. White pine is used almost exclusively in the eastern states for outside doors which are exposed to the weather; for door and window frames, exterior trim and moldings, and occasionally for interior trim. It is probably the best wood known for gluing purposes, and almost all veneered work is glued over a white-pine core.

Yellow pine is a general favorite for interior trim and certain localities. This wood is hard, heavy, and strong, and has a marked grain which roughly resembles oak. It makes an excellent flooring and takes a very nice finish. This wood is liable to crack, or check, in places subjected to extremes of atmosphere, but will give very satisfactory results for ordinary use. It is sometimes known as "southern" or "Carolina" pine. Georgia pine is similar to yellow pine but superior to it.

Cypress is undoubtedly gaining in popularity for interior trim, as it is the

one wood which can be used to advantage throughout a building, at a nominal expense, and is very beautiful when stained and finished. The wood comes from the southern part of America and Europe and closely resembles cedar in color and ease of working, but has a grain that is not obtained in cedar. Great care must be exercised in the seasoning, as it will check and become "shaky" if the drying is forced. It is sometimes difficult to work this wood into interior trim without raising the grain, and for this reason some mills and builders will not make it up.

Oak is really the best wood for interior finish, but it is a little more expensive than some of the ones mentioned. It is more expensive to work, as the wood is extremely hard, heavy, and cross-grained. The American white oak is a light, yellowish-brown color, while the red oak is darker and redder, coarser-grained, and more brittle. Both red and white oak are used extensively for floors and trim, and quartered white oak is used for veneer on a core of white pine or chestnut.

Birch is used extensively for imitation mahogany, as it has very little grain, is fine-textured, and can be used for interior trim and cabinetwork. It is hard and very durable.

Chestnut is a comparatively soft, close-grained wood and very brittle. It has become a popular interior-finishing wood on account of its peculiar and attractive graining and its adaptability to the various finishes.

Poplar, or white wood, is light, brittle, and soft, and is frequently used as a base for white-enamel work. It shrinks and warps badly in slight changes of atmosphere. Its color changes from white to a pale yellow.

Basswood bears a close resemblance to white pine, but is much more flexible. The main fault of this wood is its tendency to warp, as it shrinks parallel with and across the grain. It is used to some extent for interior finish, but principally for curved panels.

In addition to the woods mentioned there are mahogany, red gum, rosewood, ebony, black walnut, cherry, curly maple, curly birch, cedar, and

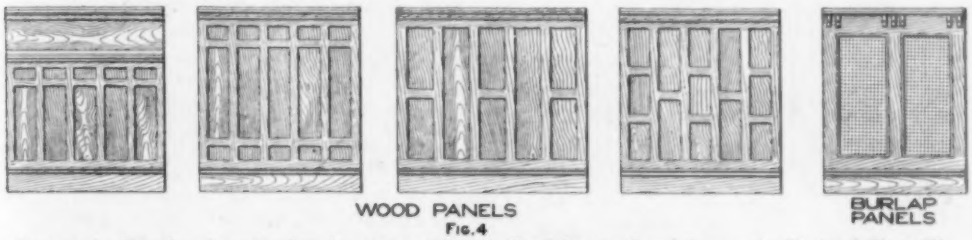


FIG. 4

Designs for Wood and Burlap Panels: Where Wood is Used for the Panel It must be Made of Three-Ply Veneer to Prevent Warping by the Changes in Weather

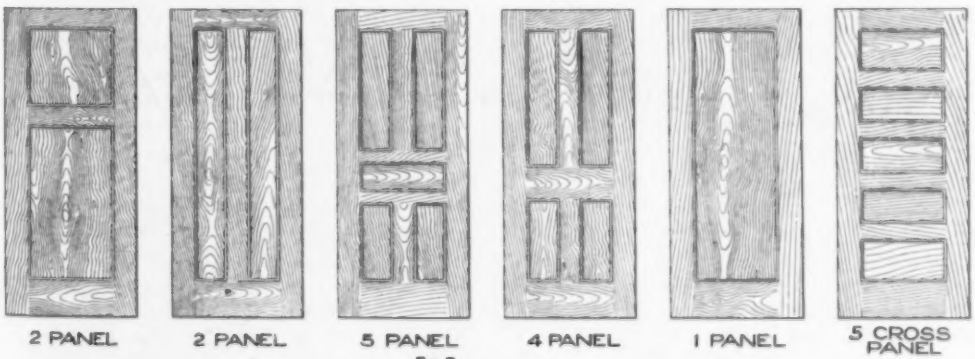


FIG. 5

Several Designs of Stock Interior Doors Carried by Lumber Dealers, Each Door Having a Different Paneling and the Cost Being Practically the Same for All Styles

many other woods, but those mentioned are the ones generally used for moderate-priced work.

If possible, use different woods in the different rooms in a house to break up the monotony. As a suggestion, use cypress for the living room; red oak for the dining room and hall; yellow pine for the kitchen and upper hall; white wood for the bathroom, and finish the bedrooms in birch, chestnut, or white wood.

This combination requires doors made with different woods on the two sides, but for the small difference in cost it will pay for the satisfaction derived. Work out the color schemes and then select the wood best adapted for it.

There are various standard styles of interior finish, the three principal ones being the mitered trim, A, cabinet-head trim, B, and back-band trim, C, Fig. 1. In addition to these are "mission," and "near-mission" trim, a few styles of which are shown in Fig. 2.

All trim should be sprung into place, fitted tightly and securely nailed to the studs with eight-penny finishing nails. Baseboards may be of the styles shown in Fig. 3. Some suggestions for paneling are shown in Fig. 4. If oak panels are used they should be three-ply veneer to prevent warping. A few designs of stock interior doors are shown in Fig. 5, the price on all being practically the same.

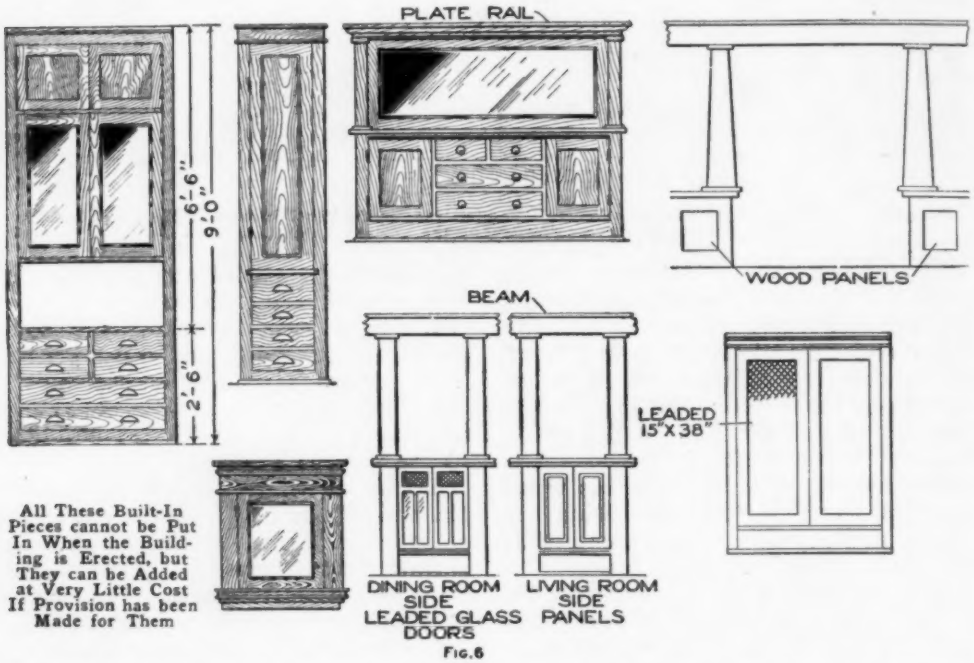


PLATE RAIL
6'-6"
9'-0"
2'-6"
BEAM
WOOD PANELS
LEADED
15"X38"
All These Built-In Pieces cannot be Put In When the Building is Erected, but They can be Added at Very Little Cost If Provision has been Made for Them
DINING ROOM SIDE LEADED GLASS DOORS
LIVING ROOM SIDE PANELS
Fig. 6

While it is not always necessary to have built-in furniture, yet sometimes a few things may be wanted, and it will not come amiss to illustrate them. These are shown in Fig. 6. All the things shown cannot be put in when the building is erected, but they can be installed afterward at little additional cost, if provision has been made for them.

Coating Solution for Laying Out Work

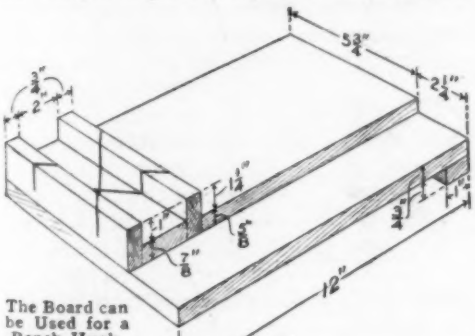
A solution made up of ½ doz. drops of copper sulphate placed in a spoonful of dissolved zinc chloride is a very good preparation for making a coat of copper on iron or steel for laying out work. This will be found a better material to use than the ordinary blue-vitriol solution.

Combined Bench Hook, Shoot Board, and Miter Box

This handy accessory to the workbench should be made of hard wood, preferably maple, and all parts accurately finished before assembling. The amount of stock required is as follows, the dimensions being in finished sizes: One piece, 12 in. long, 8 in. wide, and ¾ in. thick; one piece, 8½ in. long, 5¾ in. wide, and ⅝ in. thick; two pieces, 5¾ in. long, 1⅞ in. wide, and ¾ in. thick; one piece, 5¾ in. long, 2 in. wide, and ⅞ in. thick, and one piece, 8 in. long, 1 in. wide, and ¾ in. thick.

The various parts are assembled by gluing and screwing them to the larger piece that forms the base. The screws are put in from the bottom so that no heads will show when the box is in place on the bench. Care should be taken to keep the screws away from the places where the miter cuts are made.

As a shoot board, it is used with a 14-in. iron plane. The plane lies on its side and is pushed back and forth on the 2¼-in. ledge. For planing miters, a piece with one end cut to a 45° angle is placed against the forward



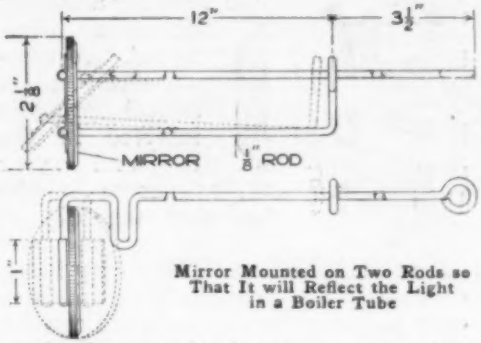
The Board can be Used for a Bench Hook, Shoot Board, or a Miter Box

stop. This holds the piece to be planed at the correct angle, and perfect joints will be the result.—Contributed by J. A. Shelly, Brooklyn, N. Y.

¶In raising a shaper knee do not loosen the screws too much, as this will allow chips to drop behind it.

Reflecting Light into Boiler Tubes for Inspection

An inspector finds it very difficult to detect any flaw, or other imperfection, in boiler tubes, superheater tubes, and



Mirror Mounted on Two Rods so That It will Reflect the Light in a Boiler Tube

arch pipes at the front, or near where they are kneaded or welded to the flue sheet. This is due to the small amount of light to be had in these places. The illustration shows a very simple device that will reflect the rays of light on the parts that require the most attention.

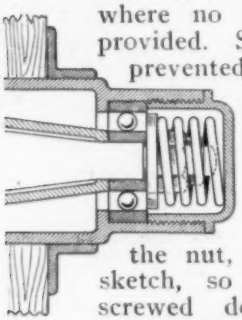
The device is very simple. The mirror used is similar to those given out for advertising purposes, on the back of which is soldered a strip of tin bent around the two rods, the ends of the rods being slightly riveted to hold the glass in place. Either of the rods may be pulled to turn the mirror at an angle in directing the light rays. The small bend in one rod is to prevent the glass from being pulled too far over the proper angle.—Contributed by Joseph K. Long, Renovo, Pa.

To Prevent Squeaking Noises on an Automobile

One frequently hears a series of squeaking noises when driving a car, and upon careful examination the trouble cannot be found. Nearly always the squeaks are caused by the body bolts and nuts loosening up a little. The body, being an extremely heavy part of the car, has a natural tendency to work loose from the chassis frame, and for this reason, secure locking means should always be provided on the various nuts.

Preventing the Loss of a Hub Cap

Quite frequently one of the hub caps of an automobile is lost, especially where no locking means is provided. Such a loss can be prevented by using a locking device as illustrated. A comparatively stiff helical spring is inserted in the cap and over the nut, as shown in the sketch, so that the cap is screwed down against the action of the spring. This spring being constantly compressed, it has a tendency to push the cap outward against the sides of the threads, and in this manner a secure locking means is obtained.

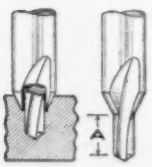


To Prevent the Rattle of an Automobile Crank Handle

Counterbore the handle end so that a short piece of coil spring can be inserted over the handle pin. This will keep the handle tightly against the crank and prevent it from rattling, yet allow sufficient free action to turn in cranking.—Contributed by Thomas M. Ritchie, Waterloo, Iowa.

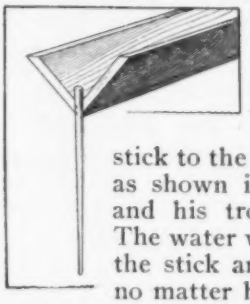
Removing a Broken Drill

In using center drills it happens quite often that the part A breaks off and remains firmly imbedded in the work being centered. In such cases grind the body, or more properly, the countersink part remaining as shown. The center drill is then rechucked and run down in the hole. This cuts a clearance around the drill and allows it to be removed with a pair of pliers. The only result in bad cases is that it makes the center a little deeper than intended. This idea, of course, cannot be applied to standard twist drills or to taps, but is thoroughly efficient for the work mentioned.



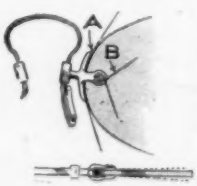
Water Guide for an Eave Trough

Having trouble in setting a barrel beneath the eave trough to catch the water during rainstorms on account of the varying volumes of water, one owner nailed a stick to the end of the trough, as shown in the illustration, and his troubles were over. The water would follow down the stick and into the barrel, no matter how much or little water was running. The stick should project above the bottom of the trough to catch the water.—Contributed by H. V. Olson, Hibbing, Minn.



Remedy for Loose Eyeglass Lens

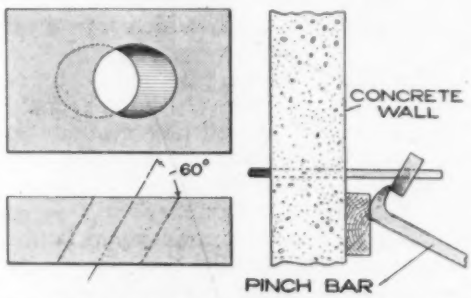
Eyeglasses generally have an annoying way of becoming loose at the screws which hold the lenses in place. This can sometimes be remedied by the insertion of a piece of cotton thread in one of the two places indicated in the sketch. If there is a space between the inner edge of the glass and the shoulder of the clip, or if the hole in the lens is too near the edge, the glass will swing slightly about the screw every time the glasses are cleaned, and this naturally loosens the screw. By removing the lens and placing a piece of thread at A, this movement is prevented, or at least greatly minimized. In addition, this makes the inside of the hole in the lens bear on the side of the screw, thus keeping it in place tightly. If the jaws



of the clip are slightly open at the edge of the lens, as shown in the lower sketch, thus making the lens wobble as indicated, it can be remedied by inserting a piece of thread, B, around the screw, crossing the ends while tightening the screw, then cutting them off, and the job is finished. The "give" in the cotton provides a sort of spring-washer effect.—Contributed by Morris G. Miller, New Rochelle, N. Y.

Puller for Concrete-Form Bolts

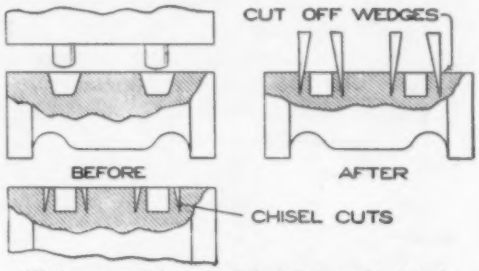
The action of the puller is the same as that of the lever jack. The holding device is made of a steel plate, 3 in. square and ½ in. thick. A hole is drilled near the center on an angle of 60° to the surface. It is only for use with headless bolts such as are commonly used for concrete-wall forms. With this style of bolt a collar and setscrew takes the place of the head. A pinch bar is used in connection with the piece of steel, as shown.—Contributed by J. J. O'Brien, Buffalo, N. Y.



The Oblique Hole in the Steel Block Forms a Grip Like a Lever Jack

Renewing Dowel Holes in Old Wood Patterns

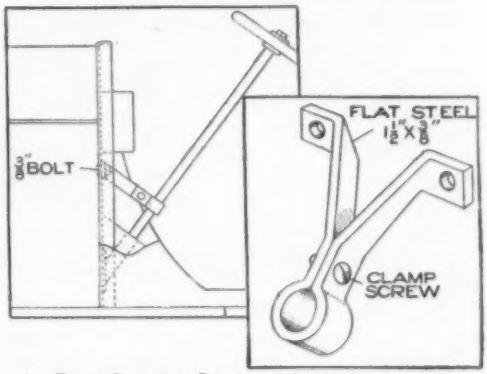
This is usually a job disliked by the patternmaker, as the holes must be plugged and new holes bored. In boring the holes the bits will be damaged by striking nails or old molding sand. It is much more satisfactory to make a cut with a ½-in. chisel, or the size suitable for the dowel, on each side of the dowel hole, running with the grain of the wood, then drive in wedges until the wood is forced to reduce the dowel hole to the proper size.—Contributed by J. C. Hansen, Maywood, Illinois.



Wedges are Driven in Chisel Cuts on Each Side to Reduce the Dowel-Hole Size

Reinforcing a Loose Steering Post

A loose steering post on an old automobile truck was reinforced in the following manner: A piece of flat steel stock, 1½ in. by ⅜ in. in cross section, was annealed and then forged into the proper shape and dimensions, as shown. This was slipped over the steering post and clamped to it by means of a ⅜-in. screw and nut. The base in turn was fastened to the steel dash with suitable screws. This supported the steering post at two points and consequently made it very rigid.

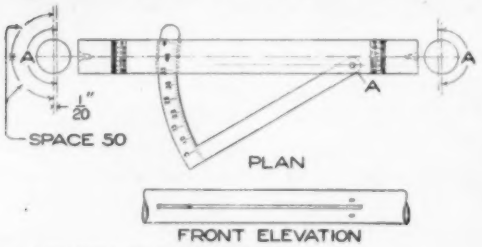


An Extra Brace to Support a Loose Steering Post of Very Old Construction

¶A forge shop should never be made too light, as the workman cannot see the heats well in a brightly illuminated shop.

A Lining and Tool-Setting Bar

The sketch shows a simple gauge for lining up various machine tools and for setting them to cut different depths. As the indicator consists al-



A=LENGTH OF GRADUATION
A Lathe-Lining and Tool-Setting Bar for Making Accurate Adjustment of the Tailstock

most of one solid piece, it is practically accident-proof and there is nothing to get out of order. The bar, or body, of the tool is first turned true, the slot for the protractor arm is cut, and the hole for the pin A drilled. The bar is then chucked, and both centers are faced off almost entirely, leaving just enough of the original centers for a marker. From this marker lay off new centers, each toward the same side of the bar and $\frac{1}{20}$ in. from the original centers, as shown. On the full side of the bar mark off the graduations, spacing them for one-quarter of the circumference with 50 graduations in each space, each graduation representing .001 in. The shaping and fitting of the protractor arm and its hub require no explanation, save to state that no locking screw is provided, the protractor arm being merely a tight fit. Caseharden the bar and grind-finish all over.

To use the instrument, set it freely on the lathe centers, move a square-point tool to almost touching the "low" side of the bar, and carefully turn it. Supposing the bar touches the tool at $20 + 3$, or 23 thousandths of an inch, without changing the tool, let the bar swing clear, and run the carriage up to the other end, and carefully turn the test bar again. If it touches the tool indicating $15 + 1$, then the lathe is out of line .007 in., and since the greater number was found at the tail-stock end, the tailstock must be moved forward .007 in. The use of the protractor needs no further explanation. —Contributed by J. B. Murphy, Plainfield, N. J.

Care of Tires Using Skid Chains

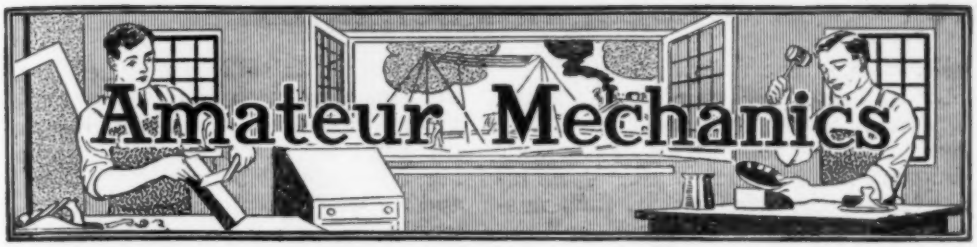
The cutting of tires with skid chains can be eliminated to great extent by using just a little care in applying the brakes, thereby increasing the mileage considerably. When the brakes are jammed on hard and quickly, instead of easily and slowly, one or both rear wheels will cease to revolve, and the section of the skid chain that happens to be between the tire and the road heats up quickly, at times becoming almost red-hot, and burns into the rubber tread. Dirt and water then get between the rubber and fabric, and loosen the tread, which wears off quickly.

The chain burning is many times called a chain cut. Although chain burning and chain cutting amount to the same thing, they are actually two very distinct damages, and by bearing in mind that rubber will burn under the conditions mentioned, much expense can be saved.—Contributed by L. E. Turner, New York City.

Shock Produces Greater Strain than Pressure

Why does a hammer blow start a "stuck" shaft when a screw pressure will not? Assuming, for example, that the pressure applied is 1,000 lb. in each case. It is a law in mechanics, known and observed by all machine designers, that a force suddenly applied produces twice the stress of one gradually applied. A blow is twice as powerful as a static pressure. In designing machine parts this must always be kept in mind, for a part built to carry a ton weight would fail under a ton blow from a power hammer.

¶Use plenty of good lard oil when cutting threads on steel.



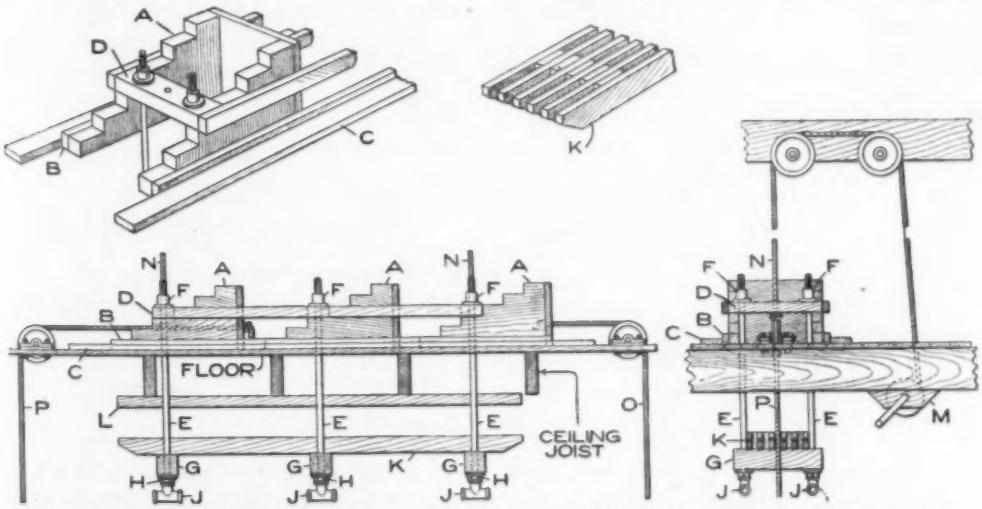
An Inexpensive Gluing Press

By N. E. STUDEBAKER

THE floor space in our high-school shop is somewhat limited, leaving no room on the floor for the gluing press, and during a large part of the year the temperature on the floor is too low for gluing. We met these conditions with the gluing press illustrated.

Three pairs, or sets, of steps, A, were made of pine, 2 in. thick, and fastened in a series by strips B, so that they all would move forward or backward between the guides C, which are nailed to the floor above the shop. On one of the steps—the corresponding one in each pair—rests a piece of wood, D, 4 in. wide and 2 in. thick, through which, near its ends, are bored holes to receive lengths of 1-in. gas pipe, E. Over these holes and screwed to the wood piece are 1-in. floor flanges, F. The pipes E are threaded at one end so that they will screw through the floor flanges about 3 in. On the other ends of the gas pipes are fitted pieces of material, 4 in. wide and 2 in. thick, G, resting on washers, which in turn rest on the locknuts H. The locknuts H prevent the tees J from unscrewing in operating the press. A rod is used through the tees as a handle for screwing the pipes E on or out of the floor flanges F. On top of the pieces G rests the floor K, on which are placed the pieces to be glued. On the under side of the ceiling joists, and directly over the floor K, is spiked the 2-in. piece L, between which piece and the floor K the material is pressed. For the sake of stiffness and lightness the floor K is built up of 1-in. material, as shown in the detail. This floor may be raised or lowered by the windlass M. The windlass is simply a ¾-in. gas pipe turning in bearings fastened to the under side of the ceiling joists.

Supposing the press to be standing

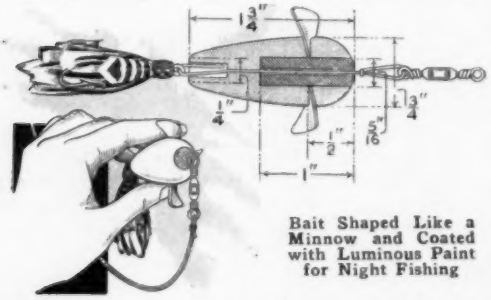


The Gluing Press is Attached to the Ceiling Where It Is Out of the Way and Where the Temperature Is More Correct for Making a Strong-Holding Joint

as shown in the drawings, it is operated as follows: The pipes E are unscrewed so that their upper ends are flush with the top surface of the floor flanges F. The ropes N are wound up a trifle on the windlass M, thus raising the pieces D, the pipes E, and the floor K. Lifting D clear of the steps releases the latter so that the entire series may be moved to the right by pulling the rope O. In unwinding the ropes from the windlass, D is let down on the lowest step, which has just been drawn directly under it. This operation lowers the floor K to its lowest limit and the pieces to be glued are placed, one on the other, on this floor. If the total thickness of the material to be glued is sufficient to nearly fill the space between the floor and the piece L, a rod is thrust through J, and the pipes are screwed up, thus pressing the material between the floor K and the piece L. If, however, the material does not fill the space well, then the ropes N are wound up on the windlass M, thus raising the floor and its contents as far as possible, and by pulling the rope P the steps are drawn as far to the left as possible and D rests on a higher step, thus lessening the space to be taken up by the screws. The pipes are then screwed up tightly as in the first operation. Our press is operated from a mezzanine floor where all the gluing is done.

A Luminous-Minnow Fish Bait

Make a plug of light wood, preferably cedar or white pine, 1¾ in. long and ¾ in. in diameter at the large end,



Bait Shaped Like a Minnow and Coated with Luminous Paint for Night Fishing

tapering to ¼ in. at the small end. Finish it to the shape of a minnow and bore a 5/16-in. hole, 1 in. deep, in the large end. Make a lead plug, with a hole through the center, to drive tightly into the hole in the head of the minnow, and finish the front end smooth and even with the wood. Run a wire through the minnow and form an eye at the tail for hooks, and another at the head for the swivel. A three-cornered piece of tin inserted ½ in. back of the head on each side and bent so that the water will cause it to turn gives motion to the lure.

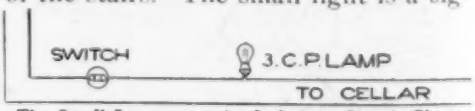
Two coats of luminous paint will be sufficient for the illumination. Expose the minnow to the light for several hours, and it will give a luminous glow in the dark that makes it easily seen by the fish as it is drawn through the water. As most game fish are night feeders, it makes a very effective lure.—Contributed by Charles Carrol, Saint Cloud, Fla.

To Prevent Putty Sticking to the Hands

When purchasing putty buy a little whiting. This is one of the ingredients of the putty. Mix enough of it with the putty to absorb the excess oil. This will prevent it from sticking to the hands. It also gives the putty more body and makes it much easier to handle.

Signal for Lighted Lights in Basement

To avoid the loss of electric current by forgetting to turn out the light in the basement, I placed a 3-cp. lamp in the circuit near the switch at the head of the stairs. The small light is a sig-



The Small Lamp near the Switch in Circuit Glows When Lights Are On in the Basement

nal that the light is still turned on in the basement.—Contributed by A. MacCunn, Toronto, Can.

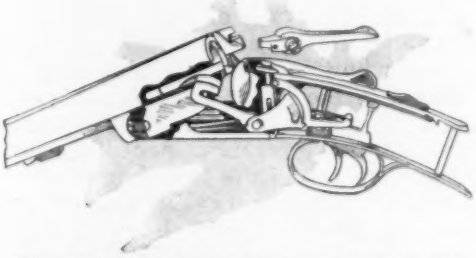
The Shotgun and How to Use It

By STILLMAN TAYLOR

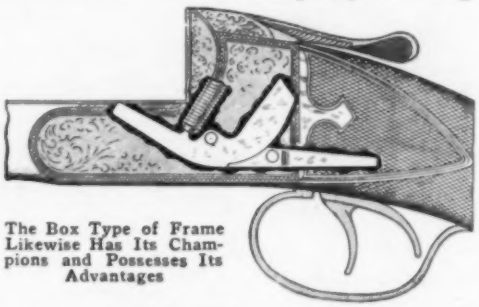
PART I—How a Shotgun is Made

HUNTING and fishing have always held the most important places in the field of sport. Primitive man was an expert hunter and a skilled fisherman. He had to be in order to secure food and skins, and while but few men are now dependent upon this method of getting a living, the call of the outdoor world is still heard by millions of men and women. This, then, may be reckoned the inheritance which our primitive ancestors have bequeathed to every man, and every man will find health and recreation through it. It would be interesting to begin this chapter at the start and set down the history of weapons, trace the evolution of the hunting arm all the way from the bow down to the modern hammerless shotgun, but as this is a practical article on how to pick out a good gun and the knack of using it, only modern weapons will be discussed. While the novice need not know the detailed process of constructing a shotgun, he will find it an advantage to know something of the way in which a serviceable weapon is manufactured, for with this knowledge he is better qualified to pick out a suitable arm for his own particular use.

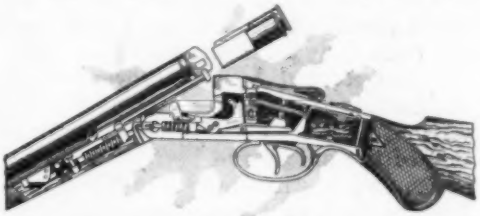
The frame of a shotgun—that is, the part to one end of which the barrels are affixed, the stock being bolted to the other—contains the lock mechanism, and that the weapon may give the utmost satisfaction for many years, the lock must be of good quality, of the requisite temper, and the bolting mechanism—securing the barrels to the frame—must be simple, yet strong and serviceable. For the frame, a solid drop forging is milled to make a shell into which the working mechanism is fitted, and two types of frames are used in making the modern shotguns. The side-plate lock is really a development of the old hammer lock, with the striker inside. This lock is preferred by some shooters because of its neat and graceful lines, and some manufacturers use this type because it enables them to make use of a lighter frame.



The Side-Plate Lock Is a Development of the Old Hammer Lock with the Striker Inside



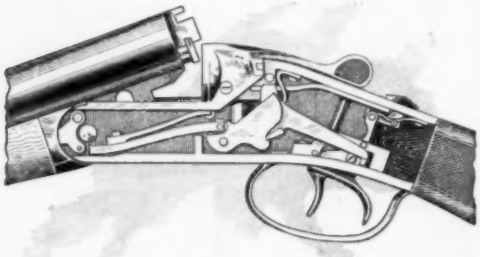
The Box Type of Frame Likewise Has Its Champions and Possesses Its Advantages



The Cocking Hook Is an Ingenious Device, with Variations Used on Different Makes of Arms

The box type of frame likewise has its champions and possesses certain advantages. Certainly it makes a strong and rigid frame, and for inexpensive weapons it would be difficult to improve upon. While its square, boxlike form is not graceful in line, it enables the maker to use a spiral, or coil, spring instead of a flat spring for operating the locks, which is an advantage. In brief, the merits of both types may be summed up in this fashion: The use of the box type of lock enables the maker to turn out a better quality of

gun at a low price, but in the case of a well-made gun, selling for a reasonable figure, there is very little choice between them so far as dependability

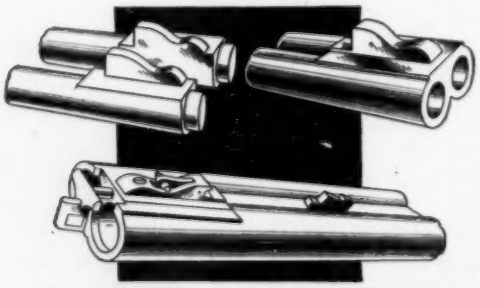


A Hammerless Gun with Roller Bearings to Overcome the Short Leverage and Make It Open and Close Easily

and long service are concerned. Both are much used by manufacturers of the finest weapons, hence the shooter may pick out the one which best suits his fancy.

The Cocking Mechanism of the Hammerless

The locks of the hammerless shotgun work inside of the frame or lock, and are cocked by an ingenious little mechanism operated by the movement of the barrels when they are opened. The Anson & Deely cocking mechanism is one of the oldest and best of these devices, and is still used on many American as well as European arms. The levers of this mechanism are hung with pivots in the end of the frame—one end



A Lug is Forged on the End of Each Barrel, and When Fitted Together They are Brazed

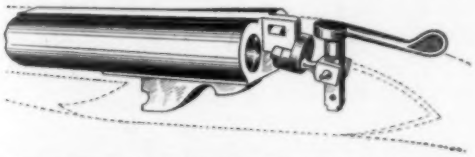
projecting into the fore end and the opposite end resting beneath the hammer toe. As the gun is "broken," or opened, it presses down the forward end of the cocking lever, and the other end rises and pushes the hammers into the cocked position. This is the principle upon which all cocking devices are constructed, and while it works smoothly and is so simple that it is not likely to get out of order, it is mechanically weak, owing to the short frame required to secure adequate leverage. Perhaps one of the best variations of the Anson & Deely device is one employed by an American manufacturer who makes use of a rod running through the frame from the fore end to the hammer. To each end of this rod is attached a crank, so hung that as one crank is depressed the other rises and pushes the hammer to the cock position as the barrels are swung to open the gun.

The cocking hook is an ingenious device found on American shotguns and many variations of it are, of course, used on the different makes of arms. The Parker gun is provided with a hook, working a slide, thus pulling the hammers to cock. In the Baker, a bent arm is pivoted to the breech to serve the same purpose. Another example of American ingenuity may be noted in the lug-cocking devices used on the Ithaca and Fox guns. This simple arrangement is made by connecting the toe of the hammer directly with the lug, which is an integral part of the barrel. The hammer is thus made to act as its own lever, for as the toe portion rises when the barrel is opened, the striker falls back until it is caught in the notch of the sear.

To guard against the possibility of accidental discharge of the hammerless gun, in which type of gun the hammer must be always at full cock, a safety trigger bolt is utilized. This bolt is affixed in the frame in a vertical position by pivoting it, and to the upper part of the lever is attached a slide, placed on top of the tang immediately back of the top lever which opens the barrels. As this safety slide is pushed, the lower end of the lever is brought close up against the triggers, blocking them, and thus prevents them from moving while the safety is in the "on" position. To discharge the gun, the slide must be pushed forward to the

"off" position, which moves the lower end away from the triggers. This type of safety is of the nonautomatic variety and can only block the triggers when the slide is operated by the shooter.

The automatic type of safety consists of a block, or bar, fitted in the frame and extending from the safety bolt to the post of the top lever. When the top lever is pushed to one side to open the barrels, this block, or bar, pushes the safety bolt over the triggers, automatically blocking them and preventing accidental discharge. The

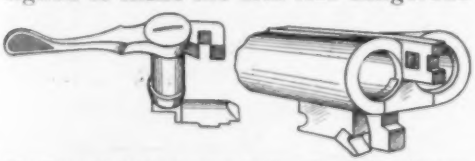


The Rotary Bolt, an American Invention, Is Strongest Device Known for Locking the Barrels to the Frame

triggers must be pressed to withdraw the automatic safety bar.

To make the shotgun less likely to go off in the hands of the careless gunner, the tumbler safety has been incorporated into the mechanism of a few American weapons. The tumbler safety is a bar, automatically operated by the triggers, and interposed between the strikers and their firing pins. This device makes it impossible for the arm to be discharged by the hammer jarring off when dropped, for the tumbler bar occupies its position between the strikers and firing pins until the triggers are pulled.

The practical value of both the automatic safety and the tumbler type of bolt is questioned by practically all experienced gunners. Its presence is designed to make the arm less dangerous



The Three-Bolt Mechanism Is One Form of the Rotary-Bolting Principle Used by Many Gun Builders

in the hands of careless and ignorant sportsmen. This it may serve to do, but since there should be no excuse for tolerating the latter, most handlers of the scatter gun fail to see the utility of the former. The novice should lose no time in acquiring the knack of han-

The Fore End Is an Extension of the Stock beyond the Triggers and the Frame

dling his chosen weapon, and if he will but exercise a little care, he will find the hand-operated safety quite sufficient, for he will not be troubled through accidental discharge of his gun. By far the larger portion of accidents occur through careless handling of the gun and by the untimely pulling of the trigger, either by dragging the gun through the brush or by nervousness, and it is impossible to make use of a safety device to prevent the accidental discharge.

The Barrels of a Shotgun

Between 15 and 20 years ago shotgun barrels were made by combining bars of iron and steel and welding them

The Comparative Sizes of a 20-Gauge and a 12-Gauge Repeating Shotgun

together to form barrels of the proper diameter or bore. When these strips of metal were twisted to make a spiral tube they were welded together to make the familiar "twist," "laminated," and "Damascus" barrels. Sometimes three, four, and five strips of iron and steel were twisted together to make the "three-stripe," "four-stripe," and "five-stripe" Damascus barrels. This old type of a barrel was strong and flexible, but being comparatively soft, it was easily damaged by denting.

The modern compressed-steel barrels are fashioned from solid drawn steel, are very hard, will stand much higher pressure than the Damascus type, and since the process of manufacture is simpler, a first-class steel

barrel may be produced at one-quarter the cost of the old type. The several manufacturers have adopted trade names to distinguish the various grades of steel barrels. Various trade names come from abroad, and those of American manufacture are labeled "nitro-steel," "armor steel," "high-pressure steel," etc. While differences very likely exist in the quality of the different barrels sold under the several names, all the barrels used by reputable gun builders will be found amply strong to resist any pressure exerted by ordinary charges of powder, hence the cheaper guns are perfectly safe and will stand many years of hard shooting.

Locking the Barrels to the Frame

In the early models of the breech-loader the barrels were locked to the frame with a bolt operated by a lever placed under the fore end. All modern guns have the top-lever action. In this device a "lump" is fastened to the under side of the barrels near the breech, forming a hinged joint to which the fore end is attached when fitting the barrel and stock together. When closed, the breech end of the barrels is held down to the action and tight up against the breech by a slide, or bolt, which fits into the "lump" attached underneath the barrels. Different makers use various forms of top-lever bolting devices, as the "hook rib" or "extension rib," otherwise known as the "doll's head," and the cross bolt first used by Greener, the celebrated English gun builder. All of these devices are satisfactory on a good grade of gun, but the strongest mechanism is an American invention, known as the Smith rotary bolt. This rotary bolt is tapered and is pushed through an opening in the rib by means of a strong spring. Mechanically this locking device is all that can be desired, and it cannot loosen through manipulation, because of its compensating feature, that is, the spring forces the bolt farther in as the bearings become worn through much service. Many of our well-known builders use this splendid fastening.

Shotgun Stocks

Walnut is exclusively used for gunstocks, and the several grades are termed plain American walnut, fine American walnut, English walnut, selected English walnut, fine English walnut, Italian walnut, and Circassian walnut. The plain American walnut is simply a common quality of black walnut, oiled and varnished, and fitted on the cheaper guns. Fine American walnut is of better quality, darker in color, and of better grain. It is strong and durable, and when well oiled and polished by hand, it makes a neat stock for the inexpensive gun. The selected English walnut is of good color and with good grain. When oiled and hand-polished it makes an attractive stock for the knockabout gun. Fine English walnut is usually fitted to guns selling at a higher price, and is generally made to order. Italian walnut is a dark wood with a fine grain and is usually supplied to order on the finest guns. Circassian walnut is the finest wood obtainable, of a rich dark color and a fine curly grain. It is therefore expensive and only finished to order and fitted to the most expensive guns.

The Fore End

The fore end is an extension of the stock beyond the triggers and frame and affords a grip for the extended hand—protecting it from the hot barrel—serves to lock the barrel to the frame, and likewise holds the ejector mechanism. The Deely & Edge, and Snal fore ends are both used on American guns, and they are so well designed and made that it is practically impossible for the modern types to loosen even when the arm has been subjected to long, hard service. Hence this detail of the shotgun need not be considered when selecting an arm.

Self-Ejector Mechanism

Although a great many shooters do not use the self-ejector, this handy device will many times prove of great value in the field, for when the birds are coming fast and the shooter happens to score a miss, the self-ejector throws out

the empty shell and enables him to shove in a fresh load to bring down the following bird. The nonejecting arm is plenty good and quick enough for trap use, for when shooting "clays," plenty of time is given each man to reload between shots, but for upland-bird and for duck shooting, the automatic ejector is a desirable addition to the double-barreled gun.

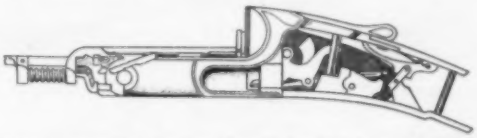
Repeating and Automatic Shotguns

While a good double-barreled gun in the hands of the average shot will very likely bag as many birds as the shooter is entitled to—and it may be depended on to do this when fitted with a good automatic ejector—many shooters prefer the repeating gun. The hand-operated, sliding fore arm, trombone-action, or pump gun is so well-known that no recommendation is needed. It will suffice to mention that it will do everything that a double-barreled gun can perform, and considering that every pump gun is self-ejecting, and its cost less than an equal grade of double gun equipped with an ejecting device, it is not difficult to understand its popularity. So far as accuracy is concerned, the repeater will shoot rather more steadily than the double-barreled gun in the hands of the average man, and after two shots have been fired, there remain four more in the magazine. Rapid firing is not always an advantage, of course, but when after ducks, the third shot is often wanted in the interval that is required to load the double-barreled gun.

The automatic, or self-loading, shot-

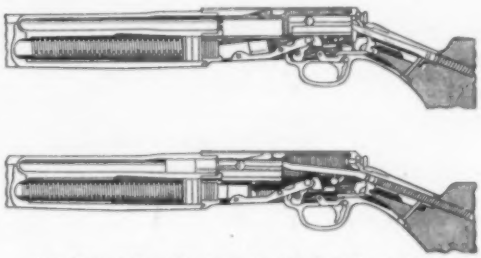
The Shells are Started About One-Quarter Inch in the Regular Way Before the Ejector Kicks Them Out

gun is the logical development of the repeater, and while its mechanism is necessarily more complicated, it has some merits peculiarly its own. The devotee of the double barrel is inclined to believe that the repeater and the automatic shotgun do not balance so well as his favorite weapon, and the man who swears by the pump gun is inclined to think that the automatic arm is balanced like a club and prone to get out of order. Both factions can put



The Automatic Ejector Mechanism Enables the Gunner to Shove in a Fresh Load for the Following Bird

up plenty of argument to support their opinions, but to the unprejudiced gunner, both the repeater and the self-loader will prove very fine guns after the shooter has become familiar in handling them. The double-barrel is a mighty fine gun, so is the repeater and



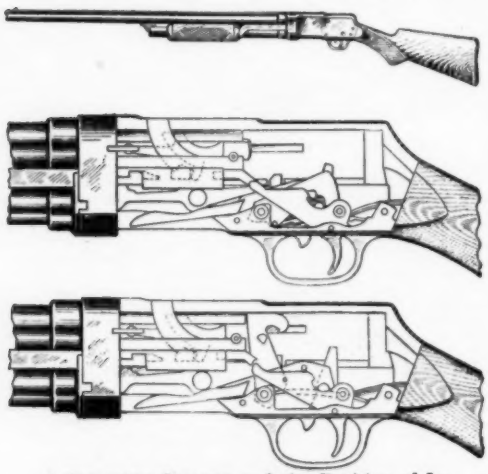
A Self-Loading Shotgun in the Positions of the Action Open and Closed

again the automatic; so let the gunner pick out the type he likes best.

How to Select a Shotgun

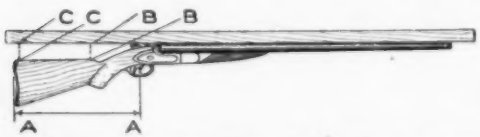
That the shooter may not be handicapped by using a misfit gun, it is well to make a selection at one of the larger dealers' where guns of various sizes, weights and lengths, as well as drops in stocks, may be tried until one is found that fits the gunner the best. A good shot can pick up almost any gun and do fairly accurate shooting with it, but he can do better work with a gun fitting him properly. The chief measurements of a gunstock are the length and drop of the stock, and the drop and shape of the comb. The ordinary thickness of the grip will suit the average hand, but in the case of unusually large or small hands, this must be taken into consideration. For the average man these measurements will prob-

ably be about right: Length of stock, from forward trigger to center of butt plate, A-A, 14 to 14½ in., drop at comb, B-B, 1½ to 1⅞ in., which will give cor-



A Repeating Shotgun and the Position of Its Different Parts When Cocked and after Firing

responding drop at the heel, C-C, from 2½ to 3 in. A fairly straight stock of good length may be reckoned an advantage for trap shooting, but for use in the field, a somewhat crooked stock with more drop at the comb, say, 1⅝ in. with 2⅝-in. drop at the heel, will more fully meet the average shooter's idea of a well-balanced gun. However, as men differ, and there are as many faces and eyes as there are men, every shooter must decide this question for himself. So far as the circumference of the grip is concerned, the size of the shooter's hand and the length of his fingers will decide this detail. For a



The Measurements are Taken of the Drop at the Comb and Heel, and of the Stock from the Butt to the Forward Trigger

small hand, a 7-in. grip is about right, while a grip of 7½ in. will probably fit the large hand well. The question of straight or pistol grip is purely a matter of personal taste, for one is as good as the other so far as accurate handling of the gun is concerned.

The Gauge, or Size of Bore

The 10-gauge may be occasionally useful for long-range duck and goose shooting, but for ordinary duck and upland use the 12-gauge is plenty large enough. The larger the gauge the greater will be the killing zone, and up to their ranges the small bores may, for all practical purposes, be regarded as shooting quite as accurately and with as much power as the heavier gauges, that is, the small bores will shoot to kill if held correctly. The standard 12-gauge gun is fitted with 30-in. barrels, weighs 7 to 8 lb., and the standard load for the field is 3 dr. of powder and 1⅛ oz. of shot. This gives a killing range up to 40 yd. The standard 16-gauge, with 30-in. barrels, weighs from 6½ to 7¼ lb., and the standard load is 2½ dr. of powder and 1 oz. of shot, with a killing range up to 35 yd. The standard 20-gauge, with 28-in. barrels, weighs from 5 to 6½ lb. and the standard load is 2¼ dr. of powder and ⅞ oz. of shot. Best killing range up to 30 yards.

For an all-purpose gun, suitable for wild fowling as well as upland shooting, the 12-gauge is the best choice, although the 16-gauge will be found a hard-hitting weapon. For the good shot, the 20-gauge will prove a fine little arm for upland work, only the gunner must shoot well with the small bore to kill his bird clean. Contrary to the notion, the large bore, not the small gauge, will bring the most game to the novice's bag.

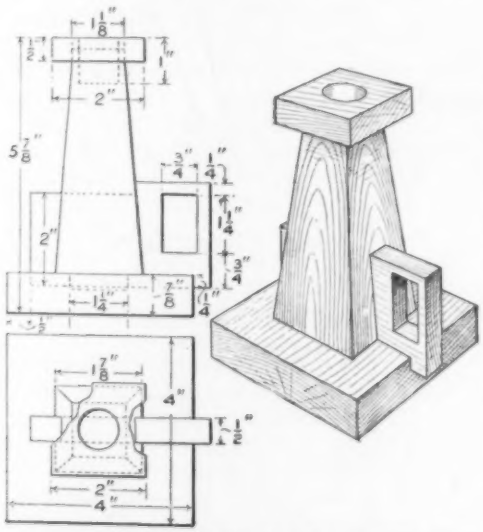
Mission Candlestick

Even though a candlestick is one of the simplest of the smaller household furnishings, it nevertheless can be made a very attractive feature.

For the illustrated mission design, a base, 4 by 4 by ⅞ in., should be provided. This is cut, with the grain, for a ½-in.-wide groove, ¼ in. deep and extending from one side to within ½ in. of the opposite side. In this groove is to fit the handle, which is made from a piece of ½ by 2¼ by 3¾-in. stock. It

is provided with a finger-grip hole ¾ by 1¼ in. at one end. Its upper edge should be marked off from the center pedestal and fitted to it. The pedestal can be made from stock 1⅞ by 1⅞ by 5 in. A tenon, ¼ in. long by 1¼ in. square, is formed on the lower end. This tenon is to fit a mortise in the center of the base. A slot ½ in. wide is cut centrally in the pedestal, and 2 in. above the lower end, to fit the handle. The upper end of the pedestal is cut straight for ¼ in. and squared off to 1⅛ in. This is to serve as a tenon to fit a corresponding mortise in the ½ by 2-in. square top. The sides of the pedestal are evenly tapered off from the 1⅞-in. square base to the lower end of the 1⅛-in. square tenon, at the top.

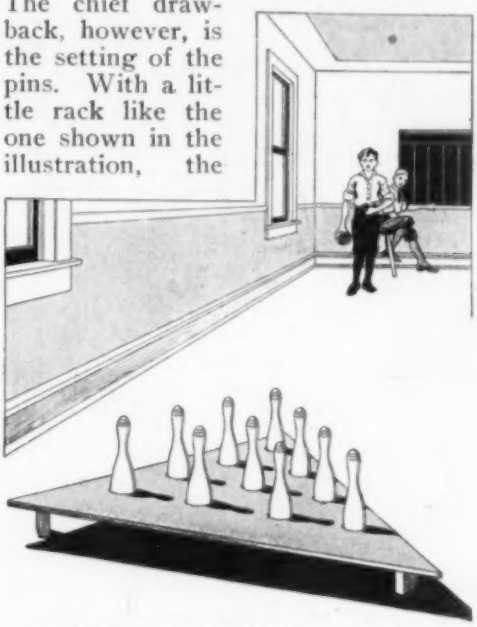
The parts, before assembling, should be thoroughly sandpapered, as considerable difficulty would otherwise be experienced. No nails or screws need be used, as good glue will keep the parts together equally well. When completely assembled, a hole should be drilled through the top and into the pedestal, to fit the size of candle to be used. A carefully applied mission stain and varnish will give a proper finish to the candlestick.—Contributed by G. Crossley, Erie, Pa.



Mission Candlestick of Pleasing Design, That will Appear Well with Other Furniture of This Class

Pin Setter for the Home Tenpins

Bowling with a set of small tenpins, which can be purchased at a department store, is a very interesting game. The chief drawback, however, is the setting of the pins. With a little rack like the one shown in the illustration, the interest in the game may be increased considerably. It not only helps in setting the pins rapidly, but insures a good setting with the proper spacing between the pins. It is very simple to make, as it consists of a triangular piece of wood with ten holes bored into it at the proper places, the dimensions of which will be governed by the size of the pins, and three supports. The pins are dropped in the holes and the rack lifted from them.—Contributed by F. K. Howard, Los Angeles, California.



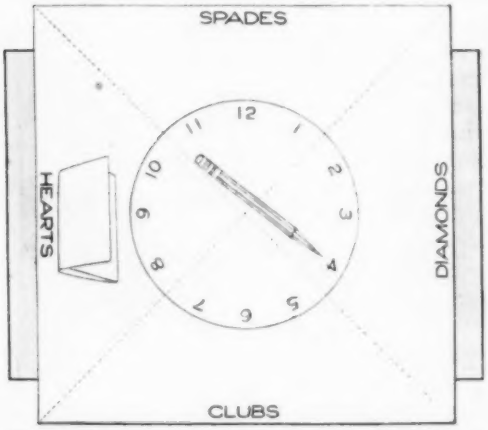
All the Tenpins are Quickly Set, and Each in Its Proper Place

Magically Naming a Written Card

This experiment consists in requesting anyone of a company of spectators to name a card and write it on a piece of paper, whereupon the performer instantly names the card written.

Two persons are necessary, the performer and his assistant. The per-

former leaves the room while the spectator writes the name of the card on the paper, the assistant supplying the



The Markings are Memorized so That Only Positions of Pencil and Paper will be Seen

paper and pencil. When the name of the card is written, the paper is folded by the spectator and handed to the assistant with the pen or pencil. The assistant lays the pencil and paper on a table in certain positions to designate the name of the card. Previous to this test, the performer and the assistant must have the positions of the paper and pencil mentally fixed in their minds. Referring to the sketch, the four sides of the table represent the card suits, viz., spades, hearts, clubs, and diamonds; and an imaginary circle divided into twelve parts indicates the number of the card, 1 standing for ace, 2 for deuce, and so on.

The assistant, knowing what has been written on the paper, places the paper to indicate the suit, and the pencil is laid so that it points to the number on the imaginary circle, or dial. The one shown in the sketch is designating the four of hearts.

Dry-Cleaning Mixture

An emulsion of gasoline and water is much used by dry cleaners for removing grease, tar, and paint spots from clothing. It is in the form of a thick, white sirup, which evaporates entirely and is not injurious to any fabric or color. The directions for preparing this emulsion should be followed out carefully.

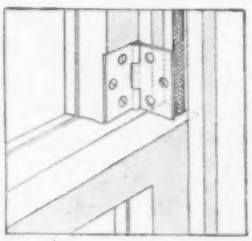
Dissolve, in 1 qt. of boiling water, ½ oz. of pure castile soap, and ¼ oz. of gum arabic. Allow this to cool, and then add 1 oz. glycerin, 1 oz. strong aqua ammonia, 1½ oz. chloroform, and 2 oz. sulphuric ether. Shake well, and pour enough of the mixture into a quart bottle to fill it for ¾ in. On top of this, pour not more than ¼ in. of gasoline, and shake until creamy. Repeat the addition of gasoline, shaking each time, until full. The cleaning mixture will then be ready for use, and may be applied with a rag, or small brush.

If, on adding the first lot of gasoline and shaking, the mixture does not become emulsified, it proves that too much gasoline has been added. In this case, allow it to stand for a few minutes, and pour off the excess gasoline which comes to the top. Shake well, and add a smaller quantity of gasoline. When the bottle is half full, larger quantities of gasoline may be added at a time.

It is interesting to note that the more gasoline is added, the thicker the emulsion becomes, and if the addition of gasoline and shaking is prolonged, a semisolid jelly is formed, which will not run from a bottle.—Contributed by H. E. Zschiegner, Wellsville, N. Y.

Locking Window Sash

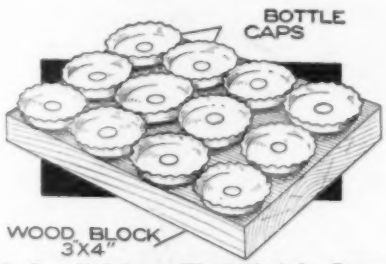
An excellent lock for window sash is to use two small, but strong, hinges,



one fastened on each side of the top sash close to the upper edge of the lower sash. This allows one wing of each hinge to swing freely, which permits it to be swung over the upper edge of the lower sash, locking both securely. In placing the hinges in this position, they are out of sight and not in the way.

A Fish Scaler

All kinds of devices, both simple and complex, have been made and patented for use in scaling fish, but for a novelty I found the following, which necessity compelled me to improvise on an outing trip, to be as efficient as any of them. As usual, the commissary, in making up the outfit, neglected to take the curry comb to clean the fish, and at the same time remembered to take a plentiful supply of bottled goods. Long before it became necessary to scale any fish enough bottles had been opened to provide the basis of a tool for the purpose, which I constructed by using the small tin bottle caps, a few being nailed on a block of wood, about 3 in. wide by 4 in. long, making a splendid fish scaler, as good and efficient at home as in the camp, and both

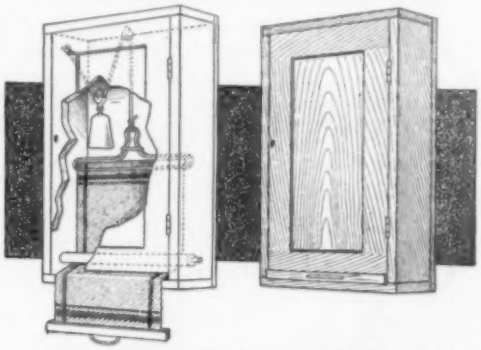


Bottle Caps Nailed to a Wood Block for Removing Scales from a Fish

inexpensive and easily made. The sketch shows the general appearance.—Contributed by T. B. Lambert, Chicago.

A Disappearing Towel

Nothing is more unsightly to a stranger entering a home than a dirty towel in either the bathroom or the kitchenette. To keep the towel out of sight I made a hanger as shown in the illustration. A wire was bent into shape similar to a clothes hanger and a sliding clip made to hold the towel in place. A cabinet was made to accommodate the towel, and the hanger was attached to a cord run over a pulley fastened at the top, through a weight pulley, and then tied to a screw eye at the top. The weight draws the towel into the cabinet. Near the bottom edge a slot was cut and a small

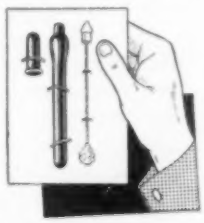


The Weight Draws the Towel into the Case Out of Sight When Not in Use

panel fitted in it. This small panel is fastened to the lower end of the towel. It is only necessary to pull out the small panel to get at the towel. When through with the towel, let loose of it and the weight will draw it into the opening.—Contributed by Chas. C. Bradley, W. Toledo, O.

Ammonia-Carrying Case for Insect Bites

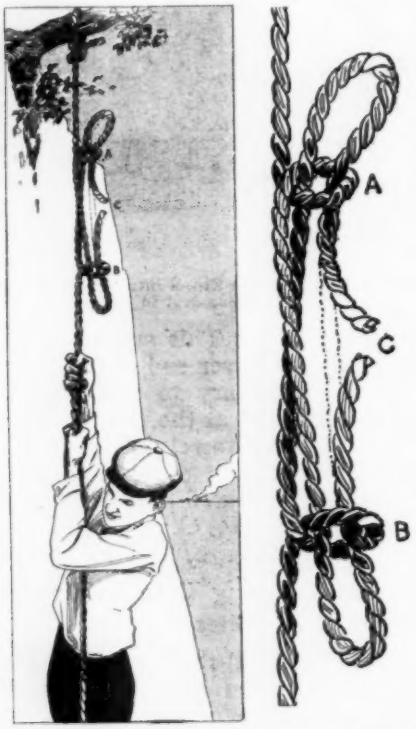
An old clinical-thermometer case can be easily turned into a vial in which to carry ammonia for insect bites. Fit a small rubber stopper in the case, then push a darning needle into the stopper so that its end will be a little more than midway in the case. Cut or break off the needle end projecting on the outside and attach a small wad of cotton to the inside end. The case is then filled with ammonia. For bee stings this works fine, as the ammonia completely neutralizes the formic acid which the bee deposits.—Contributed by E. Everett Buchanan, Elmira, N. Y.



¶The contact points of a firm-joint caliper should never be struck on hard surfaces to adjust them.

Sheepshank Knot Used to Recover Rope

The knot shown has a peculiar characteristic which enables a person to recover the rope after letting himself



Only a Small Portion of the Rope will be Left on the Projection

down from some elevated position. After the rope has been tied firmly to some support, as a limb of a tree, tie this knot, or "sheepshank," as high up as possible. Close inspection will show that one of the three sections of the knot holds no part of the weight below. This section is identified as the portion which projects through the loops A and B at both ends. The other sections project through at one end only. When the knot has been arranged, slide down carefully to a position just below it and cut the rope at C; then descend to the ground. By shaking the rope the knot may be loosened, and only a short piece will be left attached to the support.—Contributed by F. R. Gorton, Ypsilanti, Michigan.

Writing Two Colors on a Plain-Ribbon Typewriter

To write red, or any other color, on a one-color ribbon typewriter place a long enough piece of red carbon paper, or the color desired, between the ribbon and the paper. It will hold its place quite well, does the work as well as a two-color ribbon used on expensive machines, and does not cost very much. —Contributed by Leslie E. Turner, New York City.

A Simple Card Deception

The effect of this trick is not new, but the method is a new one. A card is selected by a spectator and noted, then returned to the pack, which is shuffled by the one drawing the card. Despite the thorough mixing the correct card is located by cutting the pack. The secret is this: When the card is chosen, the chooser is allowed to remove it from the pack. The performer then takes it and holds it up and asks the audience to fix it in their minds. While doing this, allow the thumb nail of the index finger to slightly graze the edge of the card. This will not show, nor can it be detected by the holder, and he suspects nothing of the kind. When returned to the deck and shuffled the pack is evened up for cutting. A glance at the edges will show a small white spot distinctly, as the scraped edge will contrast with the other soiled cards. It is simple to cut the pack from this key.—Contributed by John C. Moorehead, Minneapolis, Minn.

Catching Minnows for Bait

Instead of chasing the little fish up and down the stream to catch enough for bait, try putting a clean bit of shell in a wide-mouth jar and holding it in the water. The minnows will be attracted in great numbers, and it is an easy matter to dip them up. A bit of shell can be used also in a net. The white, shining shell seems to be a good lure for the little fellows.—Contributed by Miriam Colchester, Amherst, Can.

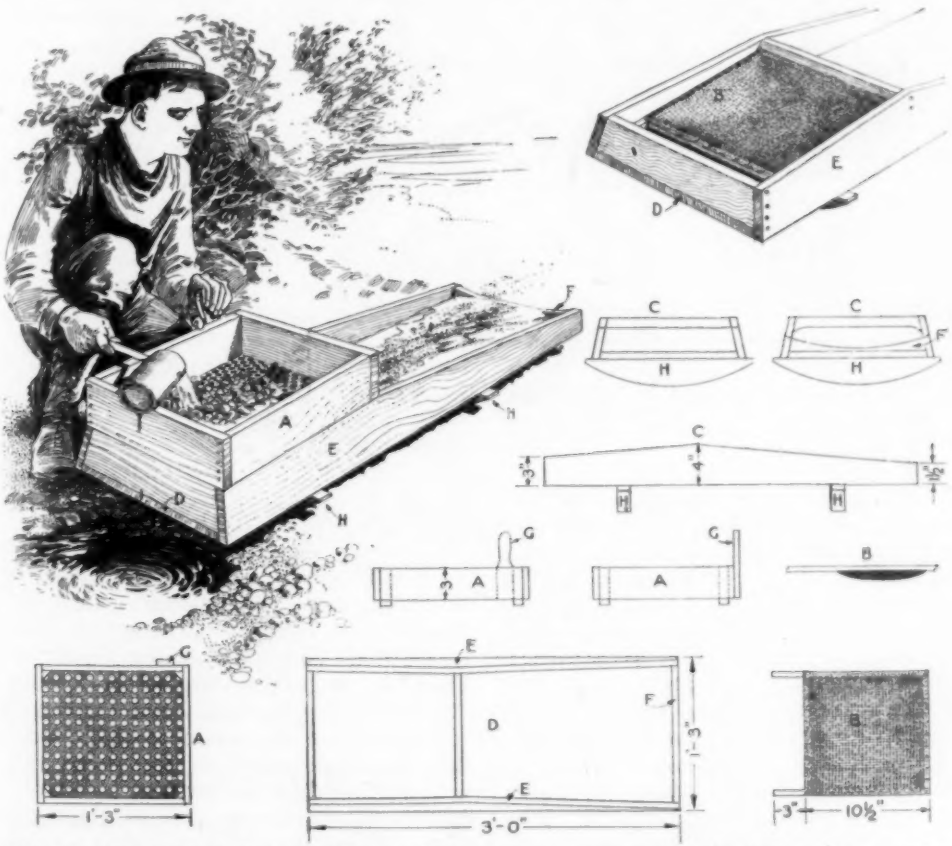
Surface Mining for Gold

By W. M. MILLS

PART II—Recovering Gold from River Beds

A VERY ancient but still popular and good way of recovering gold from river beds is to use a "cradle" or "rocker" instead of the sluice box. An assembled view of this is shown in one of the illustrations. It consists mainly of three parts: a hopper, A; an apron, or inclined riffle, B, and the cradle, or sluice box, C. Proportions and methods of construction may differ to suit various conditions. The cradle box C consists of a bottom board, D, ½ by 15 by 30 in., with the long edges planed to a slight bevel, so the sides E will tilt inward, thereby preventing excessive slopping of the water when rocking the cradle. The sides E are cut to 3 in. at one end and 1½ in. at the other, and run to a point 4 in. high about 15 in. from the 3-in. end. The low-end piece F is slightly curved from end to end to produce a more uniform flow when rocking. The hopper A consists of a rectangular frame, 3 in. high, strongly braced in the corners. On the bottom side is fastened a plate of sheet metal punched with ½-in. holes; or, better still, it may be covered with No. 5 mesh screen. The hopper rests on the high portion of the sides E, being held in place by the extensions of the corner braces which fit up against the sides. The side handle G is used to do the rocking.

Underneath the hopper—when this is in position on the cradle—is the in-

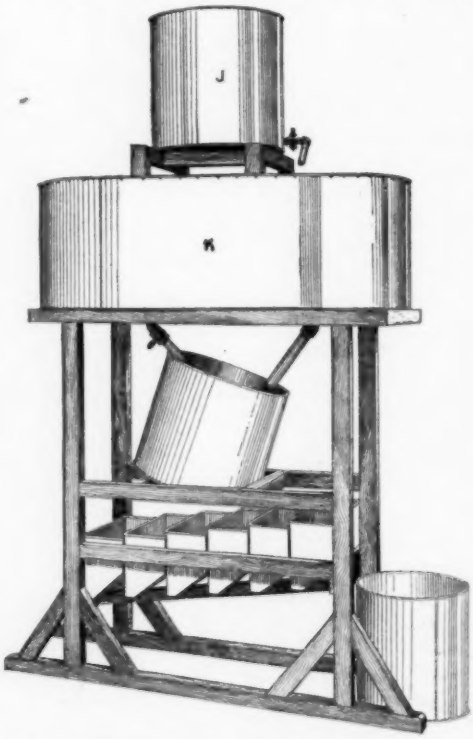


The Cradle or Rocker is Used Instead of the Sluice Box for Recovering Gold in River Beds. It Consists Mainly of Three Parts: the Hopper, Cradle, and Apron, or Inclined Riffle

clined apron, or riffle, B, which consists of a frame, 13½ in. long, loosely covered with canvas for about ¾ of its length, the remainder being open. It is supported on the high, or canvas, end by a crosspiece extending from one side to the other; the lower, or open end, rests on the bottom board of the cradle. Rockers, H, are provided to produce the necessary rocking motion. When used, the cradle should be set so as to have a slight incline of about 1 in. toward the low end.

The gold-bearing gravel or sand is placed in the hopper and water is added, at the same time rocking the cradle. This causes the sand, silt and fine gravel to be washed out, flowing down over the apron and out at the lower end. After removing the worthless pebbles and large stones from the hopper, any gold nuggets, too large to pass the screen, may be seen.

The apron, directly underneath, catches any smaller gold particles which have passed through the hopper screen. If the gold be of a very fine size, riffles, or pockets, may be formed in the apron by supporting the canvas with several crosspieces. These riffles tend to retard the flow momentarily and cause the gold particles to drop. A surer method of getting the fine gold is to put mercury in the pockets, or riffles, and produce an amalgam, which can easily be separated by means of the iron retort, as explained in the previous chapter.



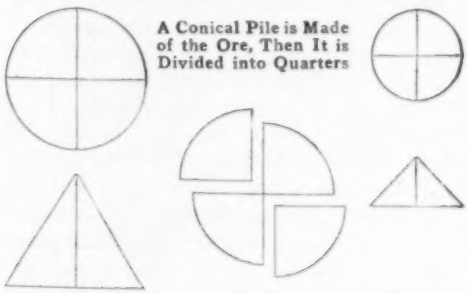
The Cyaniding Process is Especially Recommended for Desert Gold, Which Occurs in a Fine-Grained Condition

Mining in a desert would hardly appeal to the average person, but even in such regions, rich deposits of gold have been found. A different method of recovering gold must be used there. Placer mining has been used in the "arroyos," or dry washes, but changes must be allowed for, from that previously described, which applies only to places where water is plentiful. The cradling must be done without water, or with very little, as water is a scarce article in the desert and may even be more valuable than the gold. The desert gold is usually found as fine flour and must be carefully collected. Its separation from the dirt can best be accomplished in a jig, or churn. This may consist of a water-tight box open at the top. Another loose-fitting box must be provided. Its top also is open, but the bottom consists of a very fine screen. In operation, the dirt is placed in the inner box with water all around in the larger one, and the loose box—being provided with a handle—is then moved up and down rapidly in the water. This jigging action tends to arrange the dirt and the gold in separate layers, due to their weights differing considerably. After the jigging has been continued for some time, the contents of the loose box may be examined for gold; this will be found in the bottom layer, due to its weight being greater than the dirt. Where power is available, power-driven jigs may be used, the reciprocat-

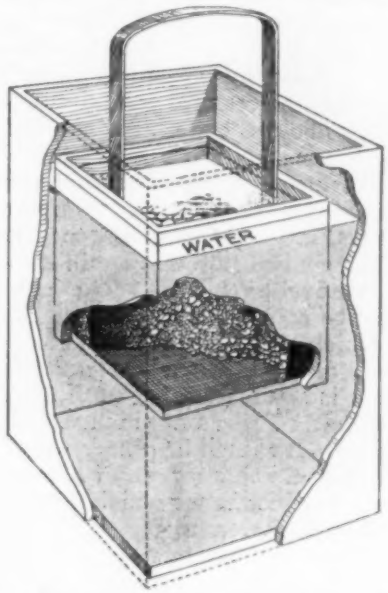
ing action being obtained by means of eccentric cams, or cranks.

The cyaniding process for obtaining gold is one of the recent methods, especially recommended for desert gold, which occurs in a fine-grained condition. The illustration represents a cyanide plant of small proportions. The finely ground ore is placed in a vat, J, where it is covered with a weak solution of potassium cyanide and allowed to stand for four or five days. The gold passes into solution and this is then drawn off into a settling vat, K, where zinc shavings are added. This will cause the gold to drop to the bottom as a black powder, which may then be collected, placed in a crucible or retort, and, after mixing it with a small amount of borax, heated in a furnace, which will cause the gold to appear in its bright metallic condition. The cyanide process is especially adapted to low-grade ores of the right condition. In its operation, special precaution must be taken not to inhale the cyanide fumes nor have any of the solution mix with drinking water, even after having passed through the soil, as it is extremely poisonous and a very small dose of it may prove fatal.

The determination of the exact value of the ore per ton is called its assay. It is the process of separating the gold from a very small sample of ore and finding its proportion to waste matter in a definite weight of sample, thereby determining the relative value of the gold per ton of ore, and of the mine, as a business proposition. The separation of gold from ore in large quantities must be carried on in specially equipped mills or smelters. Assaying may be either by the "wet" or "dry" process; the chemical analysis corresponds to the wet method, and the fire assay to the dry process; the latter



A Conical Pile is Made of the Ore, Then It is Divided into Quarters



A Jig or Churn Used to Separate the Desert Gold with Very Little Water

method is the one mostly used for gold, due to its comparative simplicity and accuracy. It consists, in a general way, in heating the ore in the presence of a lead ore; the gold and silver will combine with the lead, from which it may be readily separated; the refuse of the ore will form a slag which may be thrown away.

One of the most important operations preliminary to the actual assay of the ore—whether this assay be done by oneself or by a regular assayer—is that of taking the sample. If a batch of ore is taken from one spot and sent to the assayer, it may show a value very much too high or too low. A representative sample should be made by taking portions from various parts of the mine. "Salting" a mine sample consists in increasing its value by the addition of fine gold, or chemicals containing gold. In selling gold-mining properties, unscrupulous salting is often resorted to, and the purchaser should be on his guard against any

such practices. As an assayer's sample is usually small, a very little gold added to it would increase the valuation of the assay immensely.

An assayer's sample may consist of one or more bags of ore. This may as well be reduced to a smaller amount in the following manner: The ore should first be crushed until it will pass through about a ½-in. screen. Then a conical pile should be made and this divided into quarters, as shown in the illustration. Remove the two opposite quarters, leaving the others, then form another conical pile and again quarter and remove as before. The process should be continued until about 1 lb. is left, which should be crushed to about ¼ in., or less, when the quartering process is again repeated until about 4 oz. are left. This amount is used in the assaying. It should be pulverized so as to pass a very fine screen of about 100 mesh to the inch, after which it is ready for the actual assaying.

How to Preserve Cut Flowers

Cut flowers remain fresh for such a very brief time that any means of prolonging their life is eagerly welcomed by the flower lover. Many experiments have been tried along this line by modifying the water in which the flowers are placed. Thus, roses, carnations, and orchids have been found to keep three times as long if a small quantity of sugar is added to the water. This is taken up and helps to keep the cells of the flower from collapsing, and thus wilting. A small lump of starch has also been found beneficial. Other flowers begin to bleed as soon as they are cut, and the precious sap running out of the stem causes the cells to collapse immediately. To prevent this, the end of the stem must be quickly closed, and this is best done by searing in a flame, or by placing directly in hot water. For corsage bouquets the searing process is best, although a little tedious, as each stem must be so treated.

When flowers are placed in hot water, the water will immediately become discolored and unsightly, but a pottery vase overcomes this difficulty, and also prevents accidents, likely to occur were the hot water placed in a glass vase. There are many flowers which can be successfully treated by this process, namely, dahlias, heliotrope, Shirley poppies, nasturtiums, and maidenhair fern. The florists of California go so far as to boil the stems of the brilliant Poinsettias, or Christmas flowers, for which they are so famous. The stem is first stuck through a large sheet of paper to prevent the steam from rising directly into the flower and injuring it.

Carnations and chrysanthemums will keep almost twice as long if placed in fresh water daily and a small piece is clipped from the ends of the stems each time. While cutting this piece off, keep the stem under water so that no air bubbles are allowed to enter the stalk and thus retard the upward flow of water.

Violets often lose their fragrance after being picked, especially the larger varieties. If they are placed under a glass globe immediately and no air is allowed to reach them, they will retain their fragrance until wanted for use. To keep a quantity of violets to send away or to use later, tie them in bunches, sprinkle with water, wrap in a wet newspaper and place in a cool spot.

If large-headed flowers, such as chrysanthemums or peonies, are to be sent some distance, insure their arriving in good condition by wrapping each blossom separately in waxed paper. This is best done with a sheet of paper about 12 in. square. In the center of one side make a slit to the center of the paper. Pull the flower stem to the center of this slit so that the blossom rests in the very center and above the paper. Draw the four corners together over the flower and twist them well.

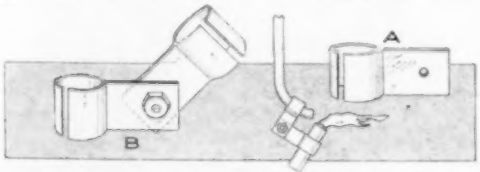
The main thing to be remembered about cutting flowers is to wait until the sun has left them, either in the evening, or, preferably, in the early morning while they are still wet with dew.—Contributed by Mabel H. Wharton, Oakland, Cal.

Repairing Sectional Spun-Metal Candlesticks

In repairing hollow, spun-brass candlesticks I find that frequently the metal rod holding the sections together becomes loosened from the pitch composition designed to hold it in the base. By tinning the outer edges of the sections that fit into the other portions, which are also tinned on the inner surfaces, and then using an iron, or an alcohol torch, to run the solder together at these points, I secure a very firm job. Paper can be placed at points necessary to keep the solder from running out of bounds. When the rod is firm and the nut only gives trouble, solder can be used to fasten the nut permanently to the grease cup at the top.—Contributed by James M. Kane, Doylestown, Pa.

Alcohol Blowtorch for Difficult Soldering

To solder in close places, I have found the device illustrated quite convenient, as it leaves both hands free to handle the object being soldered. Two pieces of spring brass, about 3 in. long and ¼ in. wide, are bent to the shape shown at A and clamped together with a screw taken from a dry cell, as shown at B. This device clamped to the blowpipe end and fitted with a tube, such as used for holding pencil leads, filled with a wick saturated in alcohol, completes the blowtorch. It makes an excellent tool for small work, as the hands are free to hold the parts to be soldered in place.—Contributed by J. A. Tandy, Ghent, Ky.

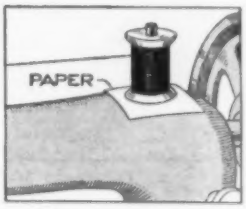


Clamps for Holding the Alcohol Receptacle on the End of the Blowpipe

¶Electric wires should never be run crooked.

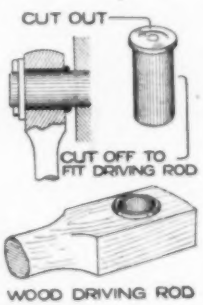
Preventing Sewing-Machine Thread from Tangling

The highly enameled surface of a sewing-machine arm offers so little resistance to the bottom of the spool that the thread will unwind faster than it is used, thereby causing a tangle. A piece of paper slipped over the spool post will cause enough friction to prevent the spool from revolving beyond the proper speed.



Bearing Made of a Brass Cartridge

A brass cartridge makes a good bearing to fit in a wood driving rod used to run a small piece of foot-power machinery. It prevents wear on the wood and admits more lubrication than the bare wood. Cut the cartridge to the proper length, and ream out the cap hole even with the diameter of the bore of the shell.



Lighting a Match in the Wind

To light a match in a stiff wind is very easy if the wood part back of the prepared end is cut and turned up about it before striking the match. The curled-up shavings about the striker will catch fire easily and hold a flame, where in the ordinary way it is easily blown out when the composition of the striker has burned up.—Contributed by E. K. Marshall, Oak Park, Ill.

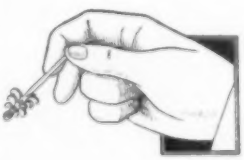


FIG. 1

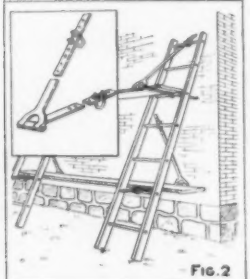


FIG. 2

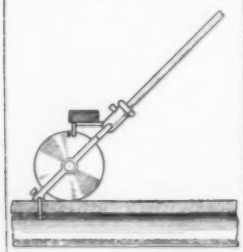


FIG. 3

FIG. 4

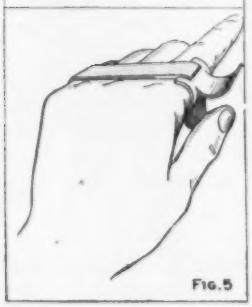


FIG. 5

INTERESTING NEW PATENTS

THEFT INDICATOR FOR AUTOMOBILES (Fig. 1)—This device consists simply of a plate which is designed to be locked over the license number and on which the words "Stolen Car" are conspicuously displayed, the idea being to attach this plate whenever the car is left standing at the curb or elsewhere. The plate is made to hook over the top of the license plate and is locked in place with a padlock.

LADDER SCAFFOLDING (Fig. 2)—The purpose of this invention is to provide a means of securely mounting a scaffold plank on two ladders set against a wall, and the device is so made that it can be attached either to the inside or the outside of the ladders as required. It consists of a bracket which is easily attached to the rungs, as shown.

INSTRUMENT FOR MEASURING RAILROAD TRACK (Fig. 3)—With this instrument the tedious work of measuring track with a surveyor's tape line is entirely done away with. The instrument is simply placed on the rail with the two guides at the forward end engaging the sides, and is then pushed along the section of track to be measured. The distance that the wheel travels is shown on a distance recorder carried on the frame.

NEW TYPE OF "BEAUTY MARK" (Fig. 4)—This invention is intended to provide an improvement over the ordinary patch of court-plaster sometimes used by members of the fair sex for enhancing the effects of their good looks. The new "beauty mark" consists of a sparkling stone cemented to a piece of court-plaster which may be cut in any shape to serve as a sort of border for the stone.

GUIDE FOR BILLIARD CUE (Fig. 5)—The guide is made of metal and is curved to fit over the index finger. Projecting from the outer side is a curved tongue in which the cue slides. The guide is attached to the hand with a strap passed around the fingers.

NEW BATHTUB ATTACHMENT (Fig. 6)—Through this attachment the water is carried from the faucet to the floor of the bathtub and is there discharged, so that the usual noise connected with filling the tub with water is eliminated. Inside the grating through which the water is discharged is a valve connecting with the drain pipe leading to the sewer. This valve is used for emptying the tub, and is operated by the rod that projects upward from the discharge head.

CLOTHESLINE HANGER (Fig. 7)—Evidently intended to be used with small articles such as handkerchiefs, this device consists simply of a rod which is suspended transversely to the clothesline by means of a specially designed hanger. The hanger is made of elastic metal and is so shaped that it grips the clothesline.

COMBINED FLAGSTAFF AND TORPEDO HOLDER (Fig. 8)—This flagstaff is designed for the convenience of railway flagmen, who are compelled to carry torpedoes while doing their work. The flag is secured to the staff by a rod passing through the hem, while the torpedoes are carried in the slot formed at the back by bending over the sides of the staff, which is of metal. The torpedoes are inserted and removed at the handle end of the slot, this end being opened and closed by a pivoted bar, as shown. The opposite end of the slot is permanently closed.

CORK EXTRACTOR (Fig. 9)—This extractor has a pointed shank, on one side of which is a slot. Mounted in this slot is a pivoted bar which lies flush with the shank when it is being thrust into the cork, but swings outward and engages the cork when the shank is pulled upward.

MOUSETRAP (Fig. 10)—In its attempt to reach the bait the mouse must walk out on a pivoted plate. The weight of the mouse tilts the plate sharply and the mouse is precipitated into a self-closing receptacle, or one filled with water.

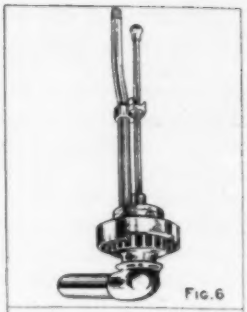


FIG. 6

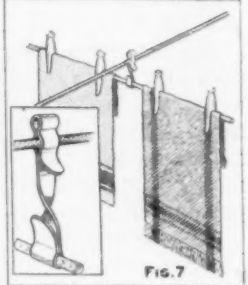


FIG. 7

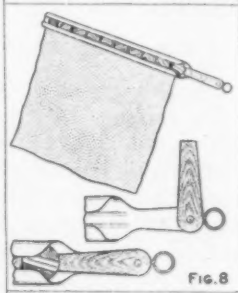


FIG. 8

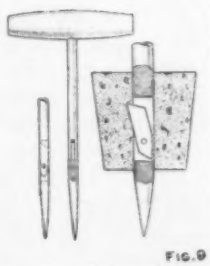


FIG. 9

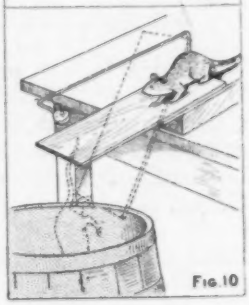


FIG. 10

FIG. 11

UMBRELLA EQUIPPED WITH ELECTRIC FAN (Fig. 11)—The umbrella has a tubular rod in which is a small electric motor and a shaft for driving the fan. The fan is placed inside the umbrella and near the top so that it throws a breeze downward on the user. It is arranged in such manner that it does not interfere with the closing of the umbrella.

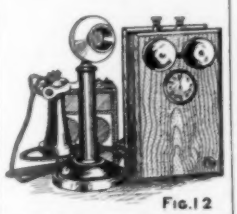


FIG. 12

SELECTIVE SIGNAL FOR PARTY-LINE TELEPHONES (Fig. 12)—This signal consists of a dial indicator and is designed for single-wire party-line circuits. In using, the pointer is set to the number of the telephone called. All the bells on the circuit will then ring, but only the indicator on the telephone called will drop to position. In case the subscriber is not within hearing of the bell, the indicator shows him that he has been called. In answering the call, he leaves the indicator as it is, and none of the indicators on the other telephones are affected.

EGG BOILER (Fig. 13)—The holder in which the eggs are placed is attached to the lid by two pivots, and is raised and lowered by the lid. With the eggs in place, the lid is closed and locked so that the eggs are lowered into the boiling water contained in the receptacle. The lock is provided with a timing device that releases the lock at a predetermined time and allows the lid to rise under the action of a spring.

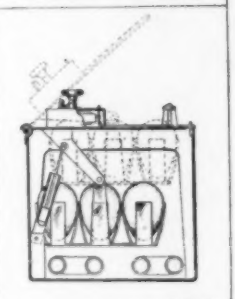


FIG. 13

ELASTIC BELT (Fig. 14)—This belt differs from other elastic belts in that no rubber is used, the elasticity being supplied by a flattened coil spring placed in a pocket at the back. This spring is shaped around two flat metal tongues, one attached to each half of the belt. The free end of each tongue is turned up to form a stop against which the spring bears. The spring is compressed as the belt is stretched.

SLIDING DOOR FOR AUTOMOBILE (Fig. 15)—The door is operated by a toggle lever, one end of which is pivoted to the door and the other to the side of the car body. The door opens when the lever is made to buckle, and closes when it is straightened out. Through the action of a spring the toggle is held in either of its extreme positions.

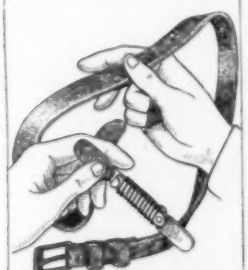


FIG. 14

PORTABLE ORCHARD LADDER (Fig. 16)—The frame on which the ladder is mounted is a vehicle having wheels at the forward end and feet at the rear end, the latter holding the vehicle stationary when in use. The ladder is pivoted near its center to standards placed just behind the wheels. It is held at any desired slope by a bar that engages one of the rungs.

FENDER FOR STREET CAR (Fig. 17)—The feature of this device is an endless belt, faced with a cushioning material, that projects to the front of the car and revolves in such a way as to pick up anything that may be struck. The belt works on two rollers, of which the rear one is driven by a rod geared to the car axle.

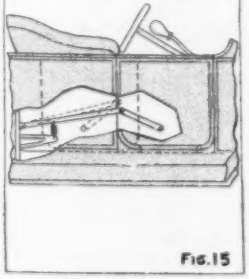


FIG. 15

LIFTER FOR PLATES AND PANS (Fig. 18)—This device is made up of two elements, both of which are equipped with claws for engaging the plate or pan. One of these elements is made entirely of wire, which is twisted at one end to form a handle and is shaped, near its center, into a slot, or guide, for the sliding bar that forms part of the second element. Claws are fixed to this bar, and the device is adjusted to any size of plate, or pan, simply by sliding the bar in the guide.

IGNITER (Fig. 19)—This device is used for producing a spark by friction, and differs from other igniters of this class in that it works like a pair of shears. The curved end of the longer arm is roughened to supply the necessary friction, and against this works the igniting material, which is carried in a casing on the shorter arm.

AUTOMATIC BENCH GRIP (Fig. 20)—This device consists of two removable jaws, with the nose ends cut away so that they overlap when free, and provided with steel pins on the lower sides with which the jaws are set in spaced holes in a bed plate. When a board is to be worked it is placed on edge and slid between the jaws, where it is held securely. The bedplate is countersunk in the workbench and is secured with screws.

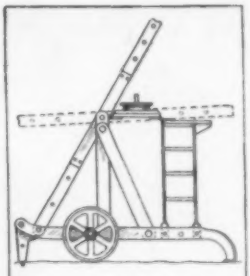


FIG. 16

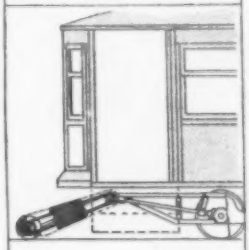


FIG. 17

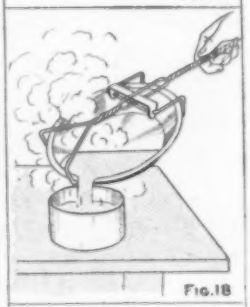


FIG. 18

FIG. 19

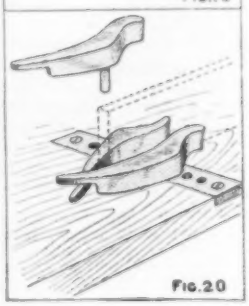
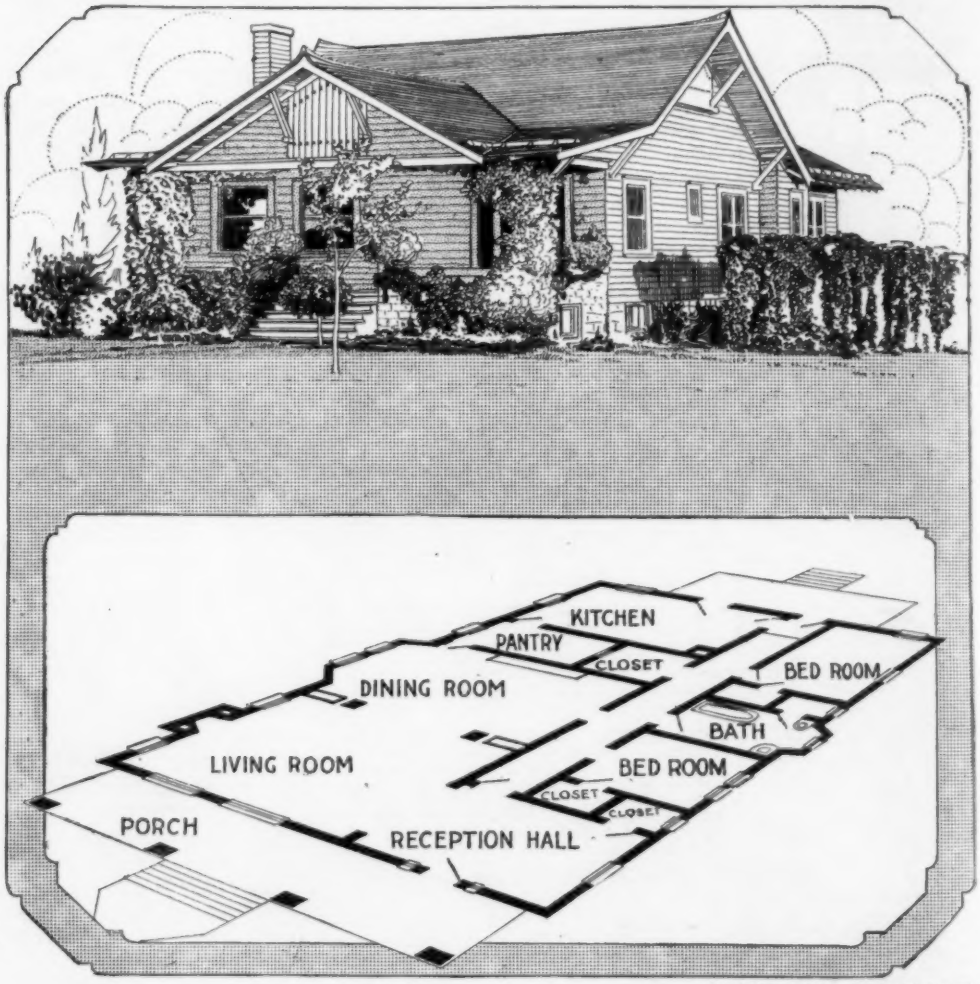


FIG. 20

A CONVENIENTLY ARRANGED FRAME BUNGALOW



DESIGNED BY MRS. R. L. WEBB, WAVERLY, MO.

THE feature about this house that distinguishes it from bungalows of the usual type is the hallway extending from the reception hall to the screened porch at the rear, and the arrangement by which every room, including the bathroom, is made to open on this hallway. The living room and dining room form practically one large room, being separated only by an archway, which is flanked by bookcases. By means of the sliding doors leading to the reception hall both these rooms can be entirely shut off from the remainder of the rooms, a feature that is often exceedingly convenient when there are guests in the house. At the rear of the hallway are two stairways, one leading to the attic and the other to the basement. An ingenious arrangement made possible by the roof gable at the rear is the sleeping porch built as a second story above the screened porch, the sleeping porch being reached by the stairway that leads to the attic. Access from the kitchen to the dining room is through the butler's pantry. This bungalow was designed with particular reference to the convenience of the housewife and is therefore well equipped with closets. The house is of frame construction. It is estimated to cost $2,250 when faced with shingles, and $2,500 when faced with stucco.

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